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Number 2

Mariners Weather Log

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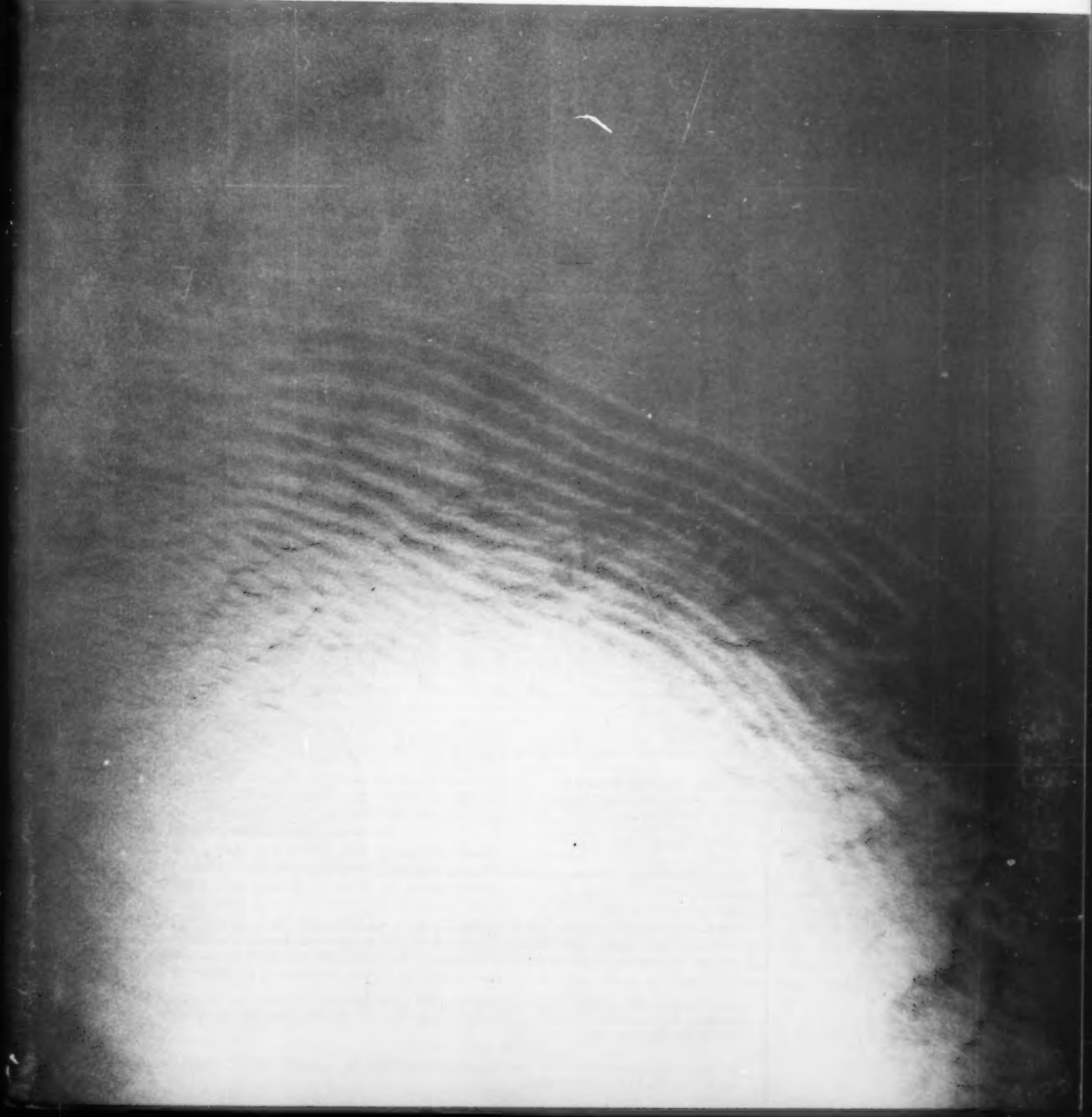

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Cover: The surface slicks caused by internal waves show up in the reflection of the sun in this outstanding U-2 photograph taken at 65,000 ft, at the head of the Hudson Canyon. For details of the experiment, see "Satellite, Ship Verify Wave Theory," on page 91.

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Editor: Elwyn E. Wilson

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Mariners Weather Log

EXTREME WIND AND WAVE RETURN PERIODS FOR THE U.S. COAST

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As interest in the coastal zone increases, so does the need for climatological information. Among the diverse projects requiring such information are oil, gas, and mining activities, offshore deepwater superport facilities, floating nuclear power plants, and fishing fleets.

Two of the most commonly asked questions regarding this zone are: "What are the extreme winds?" and "What are the extreme waves?"

For ocean areas, unlike land stations, continuous records are generally not taken. Only randomly scattered observations from ships in passage are available to help answer these questions. True, there are a few fixed light stations and ocean weather stations, but their numbers are dwindling and their coverage is too sparse to offer complete answers. Drilling rigs make intermittent observations and there are a few instrument records for near-shore areas (Thompson and Harris, 1972 and Harris, 1972), but coverage is inadequate in time and space to offer definitive solutions. As a result, innovative techniques must be used in dealing with large areas and long periods over the open oceans. A most fruitful method has been to employ the highly valuable cooperative merchant marine ships' observations and theoretical considerations to estimate probabilities for certain phenomena. The results are then correlated with the small amount of fixed point data available and models are formulated to make statistical estimates.

In this paper, extreme winds and waves for specified return periods (recurrence intervals) are estimated from existing climatological data. A mean return period is the average number of years between successive occurrences of values greater than or equal tc some threshold value. Figures 1-3 show the areas for which wind and wave statistics were computed. The results for each area are presented in tables 1-3.

THE DATA BASE

Most wind observations over the open ocean use the state of the sea as at least a partial input (U.S. Department of Commerce, 1970). Thus, the natural correlation between winds and waves is strengthened by the observing procedures. In climatological practice it is neither possible nor desirable to completely isolate the winds from the waves for analytical purposes.

Preliminary results in comparing estimated winds from merchant ships with instrumentally-measured winds at fixed locations show small differences (less than 1 kn) in the distributions between the 5th and 95th percentiles. Ocean weather stations did not show systematically different windspeed climatologies from the surrounding merchant marine observations. Rather, they showed a mixed distribution with statistically inconclusive results. The average wave heights at the ocean weather stations were about 10 percent higher than the merchant marine observations. The authors are currently investigating the fair weather and observational biases that may cause this disparity. See "A Climatic Comparison of Ocean Weather Stations and Transient Ship Records," Mariners Weather Log, Vol. 18, No. 5.

Even though the fair weather bias does not appear critical to the long term wind and wave climatology, the random scatter of ships' observations makes it unlikely that a weather report will coincide with an actual extreme. Because of this, inferential judgments are necessary to estimate extremes. A statistical approximation was used to estimate mean return periods for maximum sustained winds (Thom, 1973a).

A maximum sustained windspeed is defined as having a duration (at or above the given speed) of approximately 1 min, though the averaging time for most marine observations is more than 1 min. Peak gusts

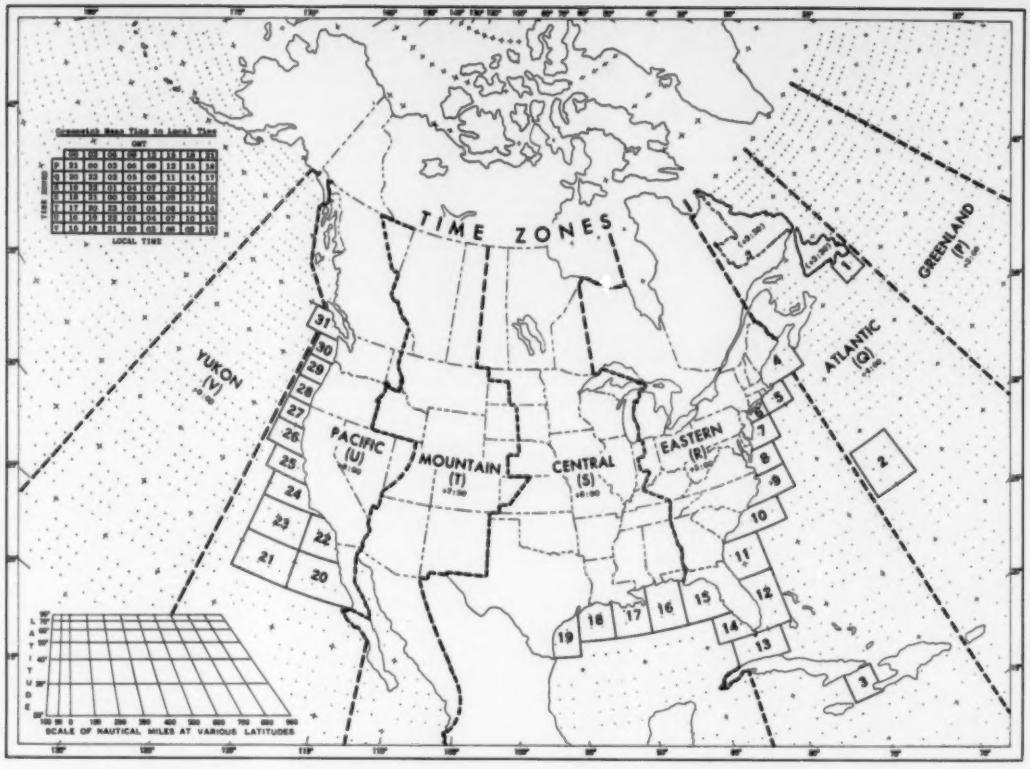

Figure 1.--North American coastal areas for which wind and wave recurrence statistics were computed.

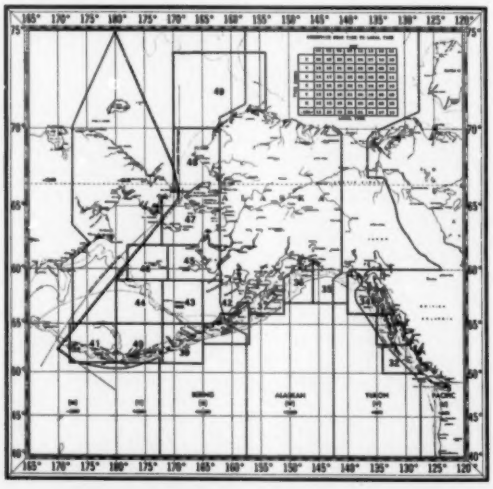

Figure 2.--Alaskan coastal areas for which wind and wave recurrence statistics were computed.

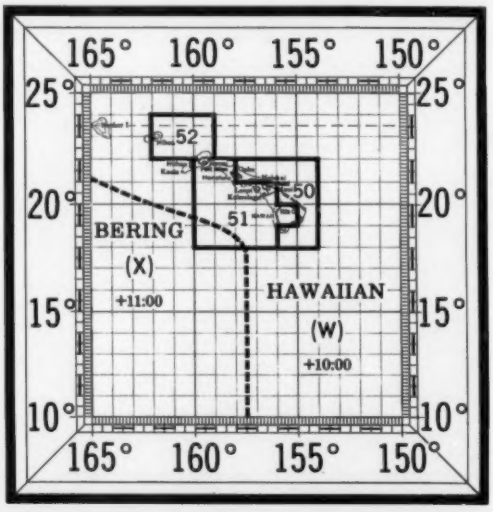

Figure 3.--Hawaiian coastal areas for which wind and wave recurrence statistics were computed.

Table 1. -- Extreme sustained windspeed estimates (knots) for specified return periods. Area numbers refer to figures 1-3.

Area	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr	Area	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
1	76	83	92	100	109	27	66	72	80	87	94
2	68	78	93	108	125	28	68	73	82	89	96
3	56	61	70	78	88	29	67	73	82	88	96
4	71	77	86	94	103	30	67	73	81	88	95
5	67	74	83	91	100	31	59	65	72	78	85
6	63	70	78	86	96	32	73	79	88	95	104
7	66	73	83	91	102	33	71	77	86	93	101
8	68	76	90	104	120	34	70	76	85	92	100
9	71	79	92	105	120	35	71	77	86	93	101
10	72	81	96	110	128	36	75	82	91	99	107
11	69	79	94	109	126	37	69	75	84	91	98
12	63	73	88	102	118	38	77	83	93	101	109
13	62	72	88	102	119	39	73	80	89	96	104
14	62	73	89	103	120	40	73	79	88	96	104
15	63	73	88	102	118	41	74	80	89	97	105
16	63	72	86	100	116	42	75	81	91	98	107
17	62	70	84	96	111	43	76	83	92	100	108
18	60	68	79	91	104	44	77	84	93	101	110
19	62	69	79	89	100	45	76	83	92	100	108
20	56	61	69	75	81	46	74	81	90	97	106
21	60	66	73	79	86	47	67	73	81	88	95
22	50	55	61	66	72	48	63	68	76	82	89
23	64	70	78	84	91	49	54	59	65	71	77
24	56	60	67	73	79	50	61	67	75	82	90
25	65	71	79	86	93	51	59	65	72	79	87
26	68	74	83	90	97	52	64	69	78	85	93

Table 2. --Significant wave height estimates (feet) for specified return periods.

Area	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
1	44	50	59	66	74
2	37	42	49	56	62
3	31	36	42	47	53
4	37	42	50	56	63
5	35	40	47	53	59
6	36	41	48	54	61
7	38	43	50	56	63
8	47	53	63	70	79
9	50	57	67	75	84
10	44	50	59	66	74
11	41	47	55	61	69
12	38	43	50	56	63
13	36	41	48	54	61
14	33	37	43	49	55
15	34	38	45	51	57
16	34	39	46	51	58
17	34	39	45	51	57
18	33	38	44	50	56
19	32	36	43	48	54
20	32	36	43	48	54
21	30	34	39	44	50
22	28	32	38	42	48
23	26	30	35	39	44
24	32	36	42	47	53
25	38	43	50	56	63
26	39	45	52	59	66
27	38	43	50	57	64
28	39	44	52	58	65
29	39	44	52	58	65
30	39	44	51	58	65
31	34	39	45	51	57
32	39	44	51	58	65
33	38	43	51	57	64
34	38	43	50	56	63
35	38	43	51	57	64
36	38	43	51	57	64
37	36	40	47	53	60
38	41	46	54	61	68
39	38	44	51	57	64
40	38	43	51	57	64
41	36	41	48	54	60
42	33	37	43	49	55
43	33	37	43	49	55
44	31	35	41	46	52
45	19	22	26	29	33
46	22	25	29	33	37
47	18	20	24	27	30
48	22	24	29	32	36
49	18	21	24	27	31
50	37	41	49	55	61
51	31	35	41	46	52
52	38	43	51	57	64

Table 3. --Extreme wave height estimates (feet) for specified return periods.

Area	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
1	80	90	106	119	134
2	67	76	89	100	112
3	56	64	75	84	95
4	67	76	90	101	113
5	64	72	85	95	107
6	65	74	87	97	109
7	68	77	90	102	114
8	85	96	113	127	142
9	91	103	120	135	152
10	80	90	106	119	134
11	74	84	98	111	124
12	68	77	90	101	114
13	65	74	87	98	110
14	59	66	78	87	98
15	61	69	81	91	102
16	62	70	82	92	104
17	62	70	82	92	103
18	60	68	80	90	101
19	58	66	77	86	97
20	58	66	77	86	97
21	53	60	71	80	89
22	51	58	68	76	86
23	47	54	63	71	80
24	57	65	76	85	96
25	68	77	90	101	113
26	71	80	94	106	119
27	68	78	91	102	115
28	70	80	93	105	118
29	70	79	93	104	117
30	70	79	93	104	117
31	61	70	81	92	103
32	70	79	92	104	117
33	69	78	91	103	115
34	68	77	90	101	114
35	69	78	92	103	116
36	69	78	91	103	115
37	64	73	85	96	108
38	73	83	97	109	122
39	69	78	92	103	116
40	69	78	91	103	115
41	65	74	86	97	109
42	59	66	78	87	98
43	59	66	78	87	98
44	56	63	74	84	94
45	35	40	46	52	59
46	40	45	53	59	67
47	32	36	43	48	54
48	39	44	51	58	65
49	33	38	44	49	56
50	66	75	87	98	110
51	56	63	74	83	93
52	69	78	91	102	115

(duration usually less than 20 sec) frequently occur and average about 1.4 times the sustained windspeed. The gusts are sometimes important to aviation and research activities, but are generally too short in duration to be of significance to ships or maritime structures.

Waves offer many analogies to winds. For one thing, the spectrum is relatively broad, with many different wave heights, periods, and directions mixing to form the wave regime at any given time. The significant wave height is defined as the average height of the highest one-third of all waves present. Frequently this height is produced by a mixture of sea (wind-generated waves still in their source region) and swell (waves which have traveled beyond the wind system which generated them). Occasionally this complex mixture of waves will get in phase, producing an extreme wave which is estimated as being 1.8 times the significant wave height (Thom, 1971; Whitemarsh, 1934; James, 1966 and 1969). Both significant and extreme wave heights are presented in this paper. High waves can occur as close in as the depth of the water will support them. Therefore, the values on significant and extreme wave conditions will not occur in the shallow coastal zone. The height of waves that can be supported is approximately 78 percent of the water depth.

COMPUTATIONAL PROCEDURES

Estimates presented in table 1 were based primarily on methods described by Thom (1973a). A mixed Fréchet distribution was fit using the monthly mean windspeed of the month with the highest mean windspeed value and the average annual probability of occurrence of a tropical storm or hurricane per 5° square in the area of interest. Monthly mean windspeeds were derived from Summaries of Synoptic Meteorological Observations (U. S. Naval Weather Service Command, 1970 and 1971). Tropical cyclone frequencies were computed from data available at the National Climatic Center. Shape and scale parameters were estimated empirically from known distributions at the ocean weather stations and then applied to areas with only randomly scattered observations. Quantitative adjustments (usually slight scale shifts) were made wher the results appeared inconsistent with known climatology of the area or adjacent areas.

Tables 2 and 3 give estimates of wave heights based on methods described by Thom (1973b). The Fréchet extreme value distribution was used as the model for the significant and extreme wave heights. Thom (1973b) derived relationships between the distribution parameters for the waves and winds using data for 12 ocean weather stations.

While a mixed Fréchet distribution would be desirable for the computation of extreme wave heights, only the Fréchet distribution with parameters related to extratropical regimes was used. There are insufficient data for tropical regimes to establish parameters for the extreme wave distributions for tropical cyclones.

As with the wind extremes, adjustments have been made to computed wave extremes when they appeared inconsistent with the wave climatology of the area or adjacent areas. This is easy to justify since in many areas, although winds may be high, the fetch and observed durations are not great enough to permit extreme wave buildup beyond certain limits.

Anyone interested in the form of the equations used, definition of parameters, etc. should consult the references under Thom, or the authors at the National Climatic Center.

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SATELLITE DETECTION OF UPWELLING IN THE GULF OF TEHUANTEPEC, MEXICO

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The daily acquisition of thermal infrared imagery from the NOAA-2 satellite permitted the delineation and monitoring of a series of upwellings in the Gulf of Tehuantepec during December 1973. The Gulf of Tehuantepec, Mexico, is a heavily-fished area noted for strong winter upwellings that lead to sea-surface temperatures several degrees lower than elsewhere along the coast of southern Mexico and Central America. December 1973 was a month marked by a series of such upwellings. The imaging radiometers aboard the NOAA-2 environmental satellite (now superseded by NOAA-3) provided a number of unique infrared images of the sea-surface temperature patterns before, during, and after their occurrence.

These NOAA satellites are in near-polar, sun-synchronous orbits at an altitude of 912 mi (1,460 km). Approximate local observation times are 0900 (daylight) and 2100 (night). The satellites carry two types of imaging radiometers, a Very High Resolution Radiometer (VHRR) and a Scanning Radiometer (SR). The VHRR has visible and thermal infrared channels collecting data with a resolution of 1 km at nadir. The SR is similarly equipped with resolutions of 4 km and 8 km, respectively. The infrared radiation information can be displayed pictorially as gray-tone imagery such that cooler features are shown as light areas (less radiant energy reaching the radiometer) and warmer areas are represented by darker tones.

The Gulf of Tehuantepec lies immediately south of the Isthmus of Tehuantepec, a major break in the Sierra Madre mountain range of southern Mexico (fig. 4). At the narrowest point of the Isthmus, where it is barely 120 mi wide, there is a gap of nearly 22 mi in the mountain range. In this area the maximum elevation is approximately 800 ft above sea level. During the dry and windy season, from November through April, cold winds originating in the Gulf of Mexico anticyclone are channeled by this topographic feature through the Isthmus and then over the eastern tropical Pacific Ocean. During these periods of high atmospheric pressure over the western Gulf of Mexico, the pressure "head" finds a "release" through this break in the Sierra Madre.

The historical December current system consists of easterly and westerly coastal currents that converge in the western part of the Gulf, then turn seaward to become part of an accelerating westward current 110 mi offshore (fig. 4). The strong regional northers, locally referred to as "tehuantepecers," are felt many miles to seaward, and effect a movement of the surface water to the south, causing entrainment of water from the sides and upwelling of water from below; a significant amount of vertical mixing occurs along the core of maximum winds as well. These effects lead to a marked decrease in the surface temperatures in the Gulf of Tehuantepec as compared to the surrounding waters. When the strong north wind moderates or ceases entirely, normal circulation features are reestablished and southward transport ceases.

Figure 4. -- Map of Mexico indicating the direction (arrows) of the historical average December coastal circulation in the Gulf of Tehuantepec.

CASE STUDY

Upwelling. -- There were five separate tehuantepecers (and associated upwellings) during December 1973. The first one began on November 29 and lasted through December 3. Figure 5 consists of nighttime and daytime NOAA-2 VHRR thermal infrared images of this single continuous upwelling. According to the Inter-American Tropical Tuna Commission, which is charged with studying and managing the yellowfin and skipjack tuna resources in the eastern tropical Pacific Ocean, this was the longest tehuantepecer noted in recent years (Miller, 1973, personal communication), as the high pressure system remained over the Gulf of Mexico for several days longer than usual. This tehuantepecer was followed quickly by four others of shorter duration (December 7-9, 10-11, 16-18, and 20-22); the series finally ended on December 22. Each of the tehuantepecers was characterized by northerly winds averaging about 20 kn, but maximum windspeeds often exceeded 40 kn (during another norther in late February 1974, one ship 1.5 mi offshore in the Gulf

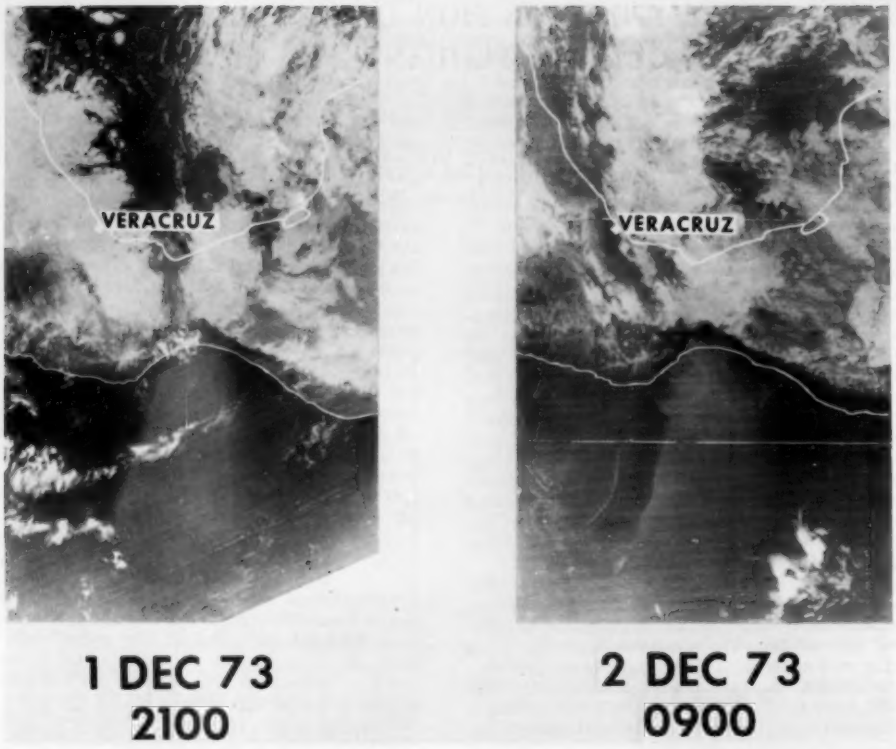

Figure 5.--NOAA-2 VHRR-IR images of the Gulf of Tehuantepec area. Left, nighttime image acquired at 2100 local time; right, subsequent daytime image acquired at 0900 local time. Irregular light areas are cold cloud tops. The cool recently-upwelled water is the light gray area that widens southward from the Isthmus.

recorded a sustained wind of 97 kn with gusts to 117 kn, and suffered extensive sandblasting).

Surface temperatures from ships in the area of upwelling (light area in fig. 5) ranged from 17° to 22°C; normal sea-surface temperatures for December are 25° to 30°C. These higher, more characteristic temperatures were noted by ships in the areas surrounding the upwelling (dark areas in fig. 5). These temperatures are in general agreement with the digitized data provided by the Scanning Radiometer aboard NOAA-2. Historical data (Wyrtki, 1964) indicate that the Gulf of Tehuantepec has a permanent shallow thermocline; the mixed layer depth rarely exceeds 80 ft, and cooler water of 22°C or less would need to be brought up from only 120 to 130 ft at this time of year. There would be no problem in mixing water to that depth under abnormally high wind conditions. As reported by ship observations, sea-surface temperatures along the maximum wind axis in the upwelling were consistently cooler than the air temperatures by 1° to 2°C during each tehuantepecer. The upwelling widens southward for about 250 mi (fig. 5), indicating that outward diffusion of water was taking place along the wind axis. The distinct western boundary of the upwelling (fig. 5) coincides with the position of the Tehuantepec Submarine Ridge, suggesting topographic control of the limits of upwelling.

Gyres.--A readjustment of nearshore currents and associated surface temperatures began on December 23. After 3 wk of nearly continuous northers and resulting upwellings, the winds effectively ceased. From a previous mean speed of 20 kn the winds in the Gulf of Tehuantepec became very light, variable in direction, and often calm for the remainder of the month--they were conspicuous only in their relative absence.

Fifteen hours had passed from the time the northers fully abated to the time of acquisition of the first VHRR infrared image in the sequence shown in figure 6. As a result of the wind cessation, the coastal currents were no longer diverted to seaward by the wind-induced upwelling, and they began a return to the historical average December circulation shown in figure 4. During this process a large circular anticyclonic gyre 100 mi in diameter developed near the coast in the western part of the Gulf (fig. 6). The cooler recently-upwelled water became entrained, with a clockwise motion, into the adjacent warmer water to the north by the readjusting currents, and served as a tracer on the infrared imagery. In this area the cool water began to moderate and approach the surface temperature of the surrounding water, as indicated in figure 6 by the intermediate gray tone of the water within the boundaries of the gyre. Progressing through December 27 in the sequence shown in figure 6, the

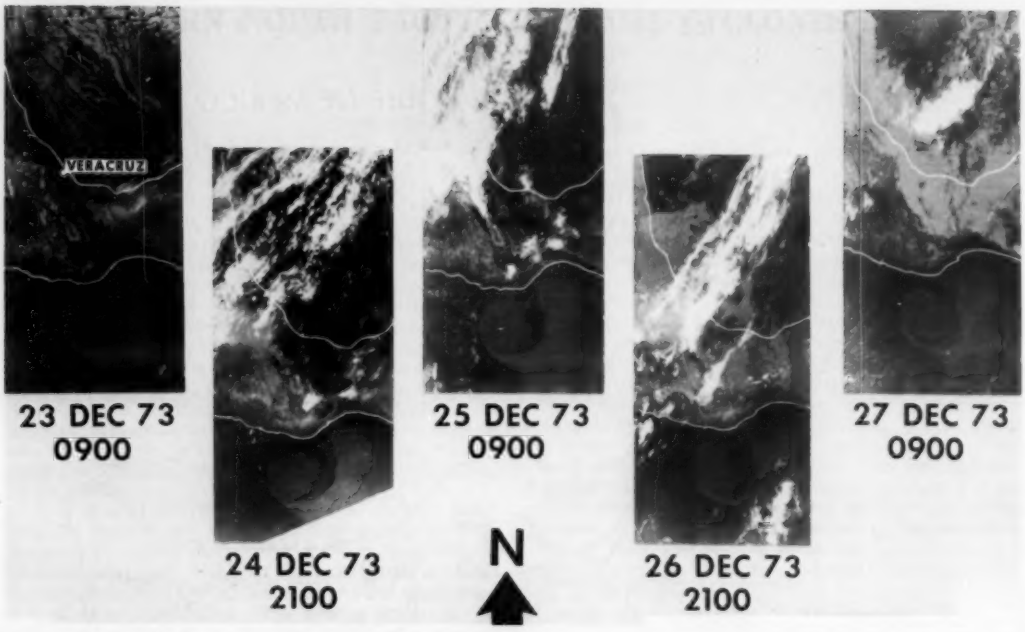

Figure 6.--Sequence of alternating daytime and nighttime VHRR-IR images of southern Mexico and the adjacent Pacific Ocean. The thermal patterns delineate a large anticyclonic gyre immediately west of the Gulf of Tehuantepec.

warm water began its movement at the northern edge of the gyre and extended along the eastern margin as it widened and apparently overrode the cooler water. The boundary of the gyre was defined on the imagery by the readjusting currents only as long as there was a thermal contrast detectable by the VHRR-IR sensor. Surface temperatures taken from ship weather observations provided by NOAA's Environmental Data Service are, for the most part, inconclusive; the patterns so obvious in the imagery (fig. 6) are not completely brought out by the 5-day composite analysis of selected ship temperatures in figure 7 (a 5-day composite was used in order to permit full coverage of the Gulf of Tehuantepec). The only distinctive feature seems to be the filament of cooler water (20°-24°C) that defines the southern margin of the gyre in figure 6.

Similar gyres, although smaller and less well-developed, were observed between the five incidences of upwelling whenever satellite coverage permitted. The presence of even moderate northerly winds at these times tended to prolong the upwelling process and to inhibit significant gyre formation. A large gyre also developed in this area after another tehuantepecer in early March 1974. Because a gyre was observed on several occasions when winds either abated or ceased entirely, it is hypothesized that the gyre is a regular transitional phase between the extreme upwelling events and the normal winter circulation and temperature distribution off the coast of southern Mexico.

CONCLUSIONS

It is apparent from this brief discussion that the VHRR, with its relatively high (1/2 mi) resolution and daily repeatability, may offer a way to improve the prediction and management of the yellowfin and skipjack tuna resources in the eastern tropical Pacific Ocean. One potential application might be to direct the fleet to possible harvests as indicated by the sea-surface temperature distribution, particularly along water mass interfaces where phytoplankton productivity (and hence feeding activity) is likely to be high.

When increased computer capability becomes available for rectification and mapping of VHRR data, the accuracy and utility of the data and imagery should increase for both oceanographic and fisheries requirements.

ACKNOWLEDGEMENTS

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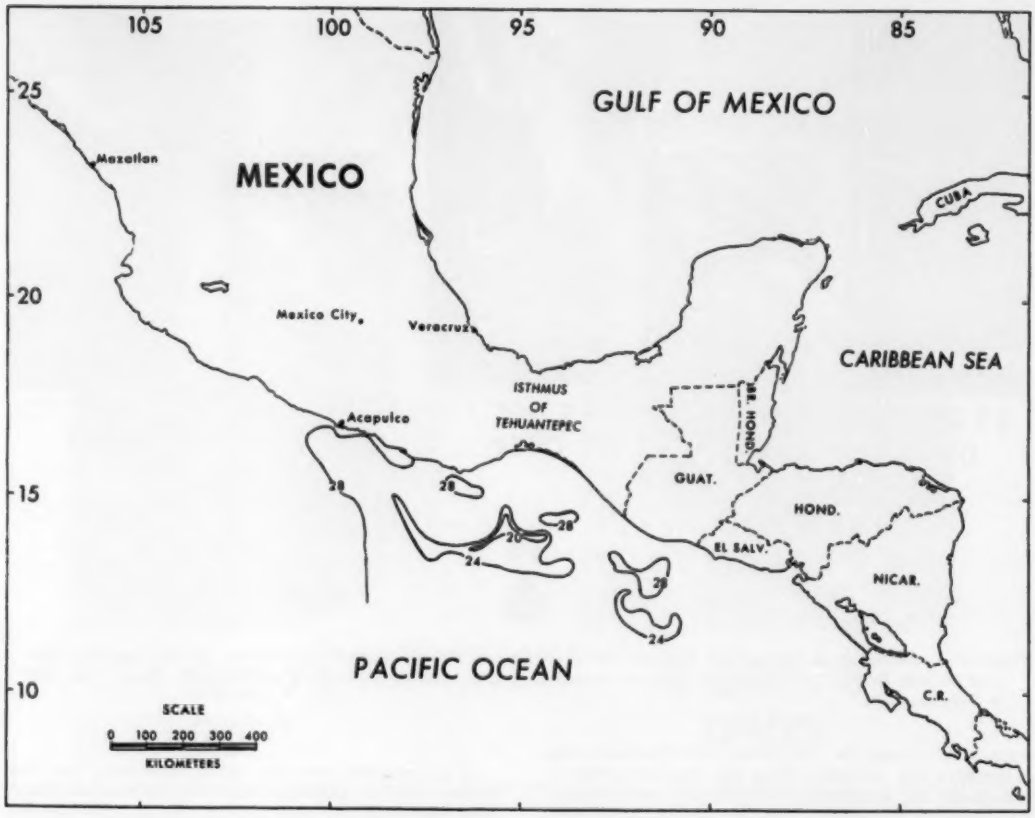

Figure 7.--Sea-surface temperatures (°C) from ships for December 23-27, 1973.

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THE MARINERS WEATHER LOG WELCOMES ARTICLES AND LETTERS FROM MARINERS RELATING TO METEOROLOGY AND OCEANOGRAPHY, INCLUDING THEIR EFFECTS ON SHIP OPERATIONS.

EASTERN NORTH PACIFIC TROPICAL CYCLONES, 1974

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The Eastern Pacific Hurricane Center had one of its busiest seasons in history during 1974. While the year's total cyclone activity was not exceptionally great, the 14-day period from August 19 to September 1 required the issuance of 34 advisories for hurricanes and 75 for tropical storms, and 30 bulletins for tropical depressions--a total of 139 issuances. Hurricanes Ione, Joyce, and Kirsten, tropical storm Lorraine, and tropical depression Maggie are shown in figure 8 with Central Pacific tropical storm Olive, on August 22-25. So much simultaneous tropical cyclone activity may not be as uncommon as might be expected. Similar activity was detected in infrared pictures from the NIMBUS I satellite, the night of September 10-11, 1966.

A total of 11 hurricanes, 6 tropical storms, and 7 tropical depressions were identified during the 1974 season. To satisfy the marine, aviation, and military requirements, 210 bulletins for tropical depressions and 237 advisories for tropical storms were prepared--a total of 447 issuances. The season began May 27 with tropical storm Aletta and ended with tropical storm Rosalie on October 24.

Tropical storm and hurricane activity by month has been tabulated in table 4, and for the 1966-74 seasons in tables 5 and 6. This period was chosen because 1966 was the first year that satellite imagery gave nearly complete coverage of the area. Storm tracks are shown in figures 9 and 10, for named cyclones. In addition, seven tropical depressions ranged from 8° to 22°N, and from 98° to 147°W.

The basic data employed in locating tropical cyclones has evolved over the years from ship observations to aircraft reconnaissance to satellite imagery. Satellite observations located systems with an adequate degree of accuracy in most cases, and the Dvorak technique was used for determining and forecasting tropical cyclone intensities from satellite pictures (NOAA Technical Memorandum NESS 45). Satellite imagery was used to locate most storms.

Looking ahead to the 1975 season, satellite pictures will probably be used to locate storm centers in all but a few cases. Reports from merchant vessels will be increasingly valuable as the only source of on-the-spot observations, because limitations on the use of aircraft may all but eliminate that valuable source of data.

Despite fuel and other restrictions during the 1974 season, the Eastern North Pacific Hurricane Center was fortunate to have more of its requests for storm reconnaissance filled by the U. S. Air Force than the National Hurricane Plan normally would have required. This was very much appreciated because it aided in the location and interpretation of storm intensity where shipping is most crowded, along the Mexican coast. Requests for aircraft reconnaissance were normally made when a storm was in a position to affect coastal and offshore waters along the Mexican coast. Three of the ten flights were into storms that had a potential to threaten the southwestern part of the United States--two into Francesca, July 17 and 18, and one into Orlene, September 23.

Known damage and casualties occurred with hurricanes Dolores and Norma. Nine people were known dead and 13 missing several days after Dolores went onshore near Acapulco, and a North Sea-type trawler, the PEREGRINE, was lost with its crew of 6. The PEREGRINE had departed Acapulco early on June 15 bound for Balboa, C. Z. Later in the season, three were killed in mud slides near Acapulco, as a result of heavy rains from Norma. The CABRILLO, a tuna boat, lost her rudder and tangled with Ione and Kirsten while under tow some 1,500 mi southwest of San Diego, during the rash of storms and hurricanes from August 22 to 25. No reports of damage have been received from merchant vessels, but some is likely to have occurred with Aletta, Dolores, Norma, and Or-

Table 4.--Monthly distribution of tropical storms and hurricanes, 1974.

	May	June	July	Aug.	Sept.	Oct.	Nov.	Total
Tropical storms*	1	1	1	2	0	1	0	6
Hurricanes*	0	2	2	4	2	1	0	11
Total	1	3	3	6	2	2	0	17

*Tropical cyclones are counted for the month in which they formed.

Table 5.--Frequency of tropical storms and hurricanes combined by months and years.

Year	May	June	July	Aug.	Sept.	Oct.	Nov.	Total
1966	0	1	0	4	6	2	0	13
1967	0	3	4	4	3	3	0	17
1968	0	1	4	8	3	3	0	19
1969	0	0	3	2	4	1	0	10
1970	1	3	6	4	1	2	1	18
1971	1	1	7	4	2	2	1	18
1972	1	0	1	6	2	1	1	12
1973	0	3	4	1	3	1	0	12
1974	1	3	3	6	2	2	0	17
Total	4	15	32	39	26	17	3	136
Average	0.4	1.7	3.6	4.3	2.9	1.9	0.3	15.1

Table 6.--Frequency of tropical storms reaching hurricane intensity by months and years.

Year	May	June	July	Aug.	Sept.	Oct.	Nov.	Total
1966	0	1	0	4	2	0	0	7
1967	0	1	0	2	1	2	0	6
1968	0	0	0	3	2	1	0	6
1969	0	0	1	1	1	1	0	4
1970	1	0	1	1	0	1	0	4
1971	1	1	5	2	2	1	0	12
1972	1	0	0	6	1	0	0	8
1973	0	1	3	0	2	1	0	7
1974	0	2	2	4	2	1	0	11
Total	3	6	12	23	13	8	0	65
Average	0.3	0.6	1.3	2.6	1.4	0.9	0.0	7.2

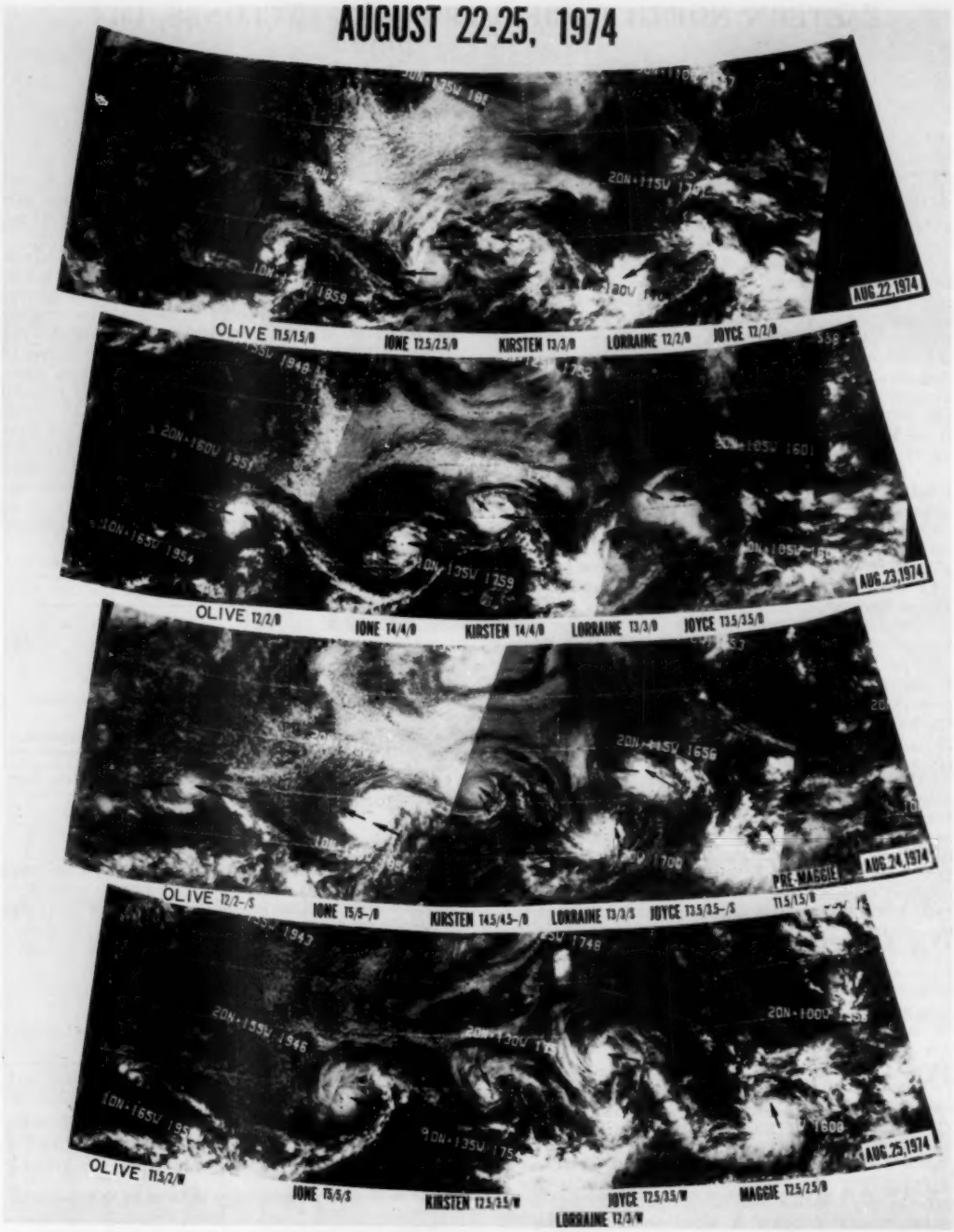

Figure 8.--The height of the 1974 eastern North Pacific hurricane season occurred during the period of August 22-25, when this sequence of satellite photos caught six named tropical cyclones between the Mexican coast and the Hawaiian Islands.

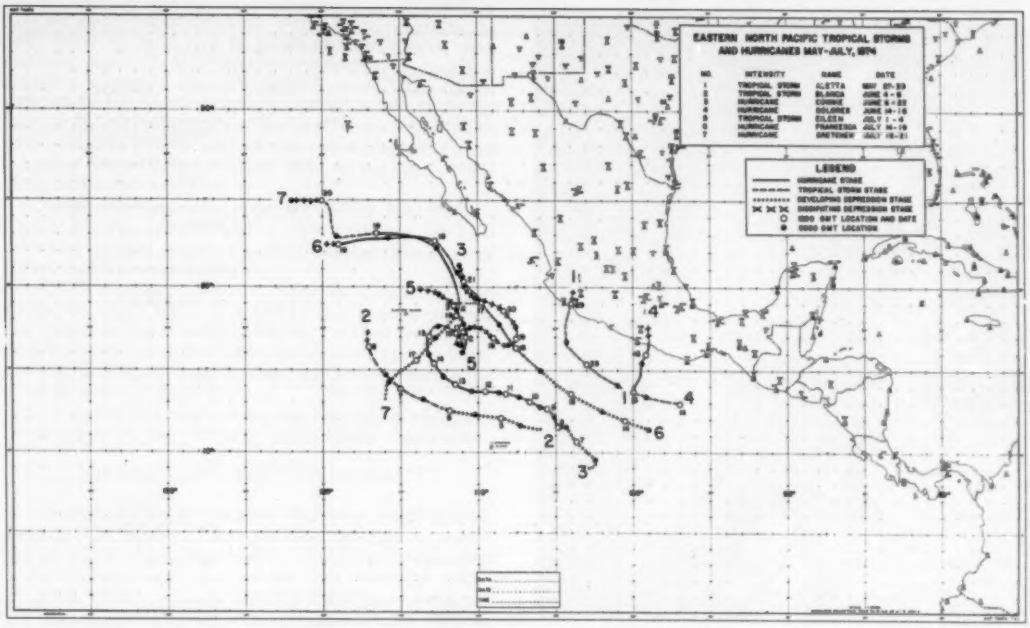

Figure 9.--Tracks of eastern North Pacific tropical cyclones, May - July 1974.

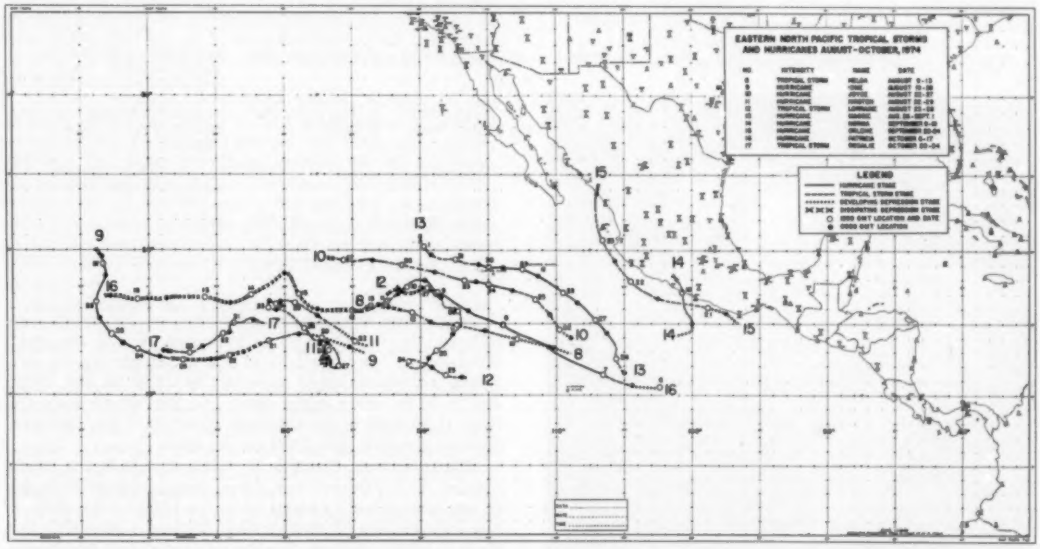

Figure 10.--Tracks of eastern North Pacific tropical cyclones, August - October 1974.

lene, as they traveled near the Mexican coast.

An unusual feature of the 1974 hurricane season was the incursion of a typical winter disturbance. The Gulf of Tehuantepec was laced with gale winds from October 5 through 8, while Patricia was developing to hurricane intensity 500 mi south of Manzanillo, and 2 wk before tropical storm Rosalie ended the season 2,000 mi to the west.

Salient features of the 1974 tropical storm and hurricane activity are included in table 7. The highest

Table 7.--Summary of eastern North Pacific Tropical Cyclones, 1974.

Name and intensity	Lifespan	Origin (°N, °W)	Dissipation (°N, °W)	Highest reported windspeed (kn)			Highest windspeed (kn), lowest pressure (mb) estimated by satellite		Remarks
Tropical storm Aletta	May 27-29	13.8, 100.3	19.1, 104.0	45	SANTA MARIA	29/1200	40	992	Moved inland about 20 mi southeast of Manzanillo
Tropical storm Blanca	June 4-8	11.5, 106.0	17.0, 117.0		None		40	992	No damage reported by shipping
Hurricane Connie	June 6-22	09.0, 103.0	21.2, 111.2	40	SHIP	16/1800	110	942	No damage reported by shipping
Hurricane Dolores	June 14-16	13.0, 97.0	16.9, 99.0	65	OCEAN HOPE	16/0600	72	973	At least 9 killed and 13 missing in mud slides near Acapulco; 6 lost on PEREGRINE.
Tropical storm Ellen	July 1-4	16.0, 111.0	20.0, 115.0		None		35	997	None
Hurricane Francesca	July 14-19	11.5, 99.0	22.5, 119.0	45 45	HOLTHAV HANYANG	17/1800 17/1800	72	973	None
Hurricane Gretchen	July 16-21	13.9, 116.0	25.0, 122.0	65 85	TAEPING USAF recon	18/1800 18/1946	60	982	None
Tropical storm Helga	August 9-13	13.0, 109.1	16.0, 124.0		None		40	990	None
Hurricane Ione	August 19-28	13.0, 124.4	19.5, 143.6		None		97	954	Passed to CPHC, Honolulu August 24, 1200 GMT
Hurricane Joyce	August 22-27	14.0, 109.0	19.5, 128.5		None		72	973	None
Hurricane Kirsten	August 22-29	13.6, 124.0	13.9, 127.3	60 50	SHIP CABRILLO	23/1800 24/1200	72	973	None
Tropical storm Lorraine	August 23-28	11.2, 117.0	16.6, 122.3	35	CAMERONIA	25/1800	50	987	None
Hurricane Maggie	August 26-September 1	11.5, 105.0	20.3, 119.9	120	USAF recon	28/1800	122	928	None
Hurricane Norma	September 9-10	14.5, 100.9	17.7, 101.2	45	OLGA JACOR	10/0000	50	987	Moved onshore 75 mi northwest of Acapulco; 3 dead near Acapulco in mud slides.
Hurricane Orlene	September 20-24	15.4, 97.0	24.0, 107.0	48 110	ATLANTIDE USAF recon	21/1800 23/2300	65	978	No report of damage. Moved onshore 20 mi southeast of Culican.
Hurricane Patricia	October 6-17	10.4, 102.4	17.0, 143.0	35	BRANSFIELD	10/0000	97	954	Passed to CPHC, Honolulu October 16, 1200 GMT
Tropical storm Rosalie	October 20-24	15.0, 131.3	13.0, 139.0		None		50	987	None

windspeed estimated by satellite may differ significantly with the highest reported windspeed, due to timing of the observations, especially where the storm intensified rapidly and moved inland, as in Orlene.

TROPICAL STORM ALETTA, MAY 27-29

Tropical storm Aletta developed slowly over warm seas, 31°C, in an area south of the Gulf of Tehuantepec, beginning May 23. A weak, closed circulation was indicated by the COSMOPOLITAN, LYCAON, MARITIME ACE, and WILD AVOCET. A westerly movement of 12 kn was indicated early in the storm's life. Rainfall reported by the ERISKAY and the ZAAN KERK south of Acapulco, at 1800 on the 26th, showed continued organization until tropical storm intensity was reached at 1700 on the 27th. The storm was moving west-northwestward at 12 kn with maximum winds of 35 kn near the center.

A gradual northwestward curve in the track was followed in hourly ATS-3 pictures during the day. Windspeeds increased to 40 kn, as measured by Air Force reconnaissance aircraft at 1700 on the 28th, and to 50 kn later in the day. As the storm intensified, it slowed to an average speed of 7 kn, between 0000 on the 28th and 0000 on the 29th.

About 0600 on the 29th, a sharp change in the track toward the northeast took place, along with an increase in forward speed to about 25 kn by 1200 on the 29th, a few miles south of Manzanillo, Mexico. At 1400, the first satellite picture for the day indicated the storm had moved inland and was dissipating.

No damage to shipping or shore installations was reported.

TROPICAL STORM BLANCA, JUNE 4-8

Northwest winds of 30 kn by the CHIEH HSING,

420 mi south-southwest of Manzanillo, Mexico, at 1800 June 4, indicated a tropical disturbance was forming near 11.5°N, 106°W. Successive satellite pictures showed a westerly movement of 12 to 15 kn, with little change in intensity during the first 24 hr. During the following 24 hr, the disturbance slowed to an average of 7.5 kn and increased to tropical storm intensity near 13°N, 113°W, at 1800 on the 6th. Winds were estimated at 35 kn.

During development, the AMERICAN RELIANCE, CHIEH HSING, TAIKU MARU, THEREN, and WORLD BANNER helped locate the cyclone, though all were well away from the center.

Blanca reached maximum intensity of 50 kn at 1800 on the 7th, after which a gradual curve northward took the storm to near 14.5°N, 116°W, at 0000 on the 8th. As Blanca moved northward over cooler waters, decay was rapid. By 1800 on the 8th, winds had decreased to 25 kn near 17°N, 117°W.

The storm traveled in an area of active shipping, but no winds of gale force or higher were reported.

HURRICANE CONNIE, JUNE 6-22

A low-pressure circulation centered about 500 mi south of Zihuantaneo, Mexico, was apparent in satellite pictures beginning June 6. No vessels reported in the vicinity until 1800 on the 7th, when the BARCELONA MARU and the JOHN PENN observed easterly and westerly 15-kn winds, respectively, each about 100 mi from the center. A northwesterly direction of movement at 5 kn was indicated in successive satellite pictures on the 7th. The depression slowed as it intensified to a tropical storm, at 1800 June 8, near 12°N, 105°W. A 3- to 4-kn movement continued to near 13.5°N, 109.5°W, with windspeeds of 35 to 40 kn.

A more westerly movement began, at 0000 on the 11th, near 13.5°N, 107.5°W, and windspeeds increased to hurricane force, by 1800 on the 12th, near 14°N, 110°W. The first hurricane spotted by the Geosynchronous Operational Environmental Satellite (GOES), from some 22,000 mi above the Equator at longitude 45°W, is shown in figure 11. Further intensification to 110 kn was indicated, at 0000 on the 14th, near 15°N, 112°W. Figure 12 shows Connie in classic hurricane form.

Reports from the AMERICAN LEGION and HOLY, 75 mi north and south of the hurricane, respectively, indicated only 25-kn winds in their 1800 observations on the 13th, indicating the concentrated circulation in some eastern North Pacific hurricanes. At that time, the winds were 90 kn near the center.

A gradual curve in the hurricane track took the center to 16°N, 113°W, at 0000 on the 15th, with the winds weakening to 75 kn, and further to tropical storm strength, at 0000 on the 16th.

As Connie moved over cooler waters, she continued to weaken and curved eastward, forming a loop near 17°N, 112°W, on the 17th and 18th. She became a tropical depression, from 1200 on the 17th to 0000 on the 19th, but regenerated to a tropical storm for about 24 hr, near 16.5°N, 108°W, and then curved northwestward again through the 21st. The disturbance dissipated near 21°N, 111°W, at 0000 on the 22d, but a swirl of cloud was still evident in the area through the 23d.

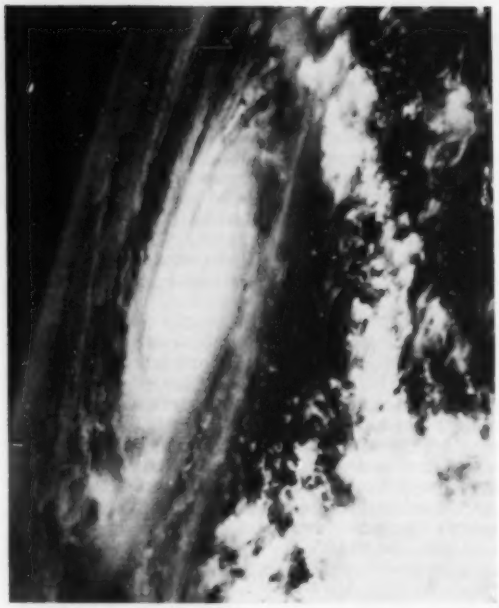

Figure 11.--A GOES view from far to the east of hurricane Connie, June 12. The satellite's primary mission was with the GATE (Global Atmospheric Research Project and Tropical Experiment) program in the Atlantic. It has since been moved from 45°W to 75°W to replace ailing ATS-3.

Figure 12.--Hurricane Connie, 1630 June 13, centered 480 mi southwest of Manzanillo, near 14°N, 111°W. The storm is approximately 200 mi in diameter with an eye 20 mi across. Maximum winds reached 110 kn near the eye wall.

HURRICANE DOLORES, JUNE 14-16

A tropical disturbance began developing 300 mi south of Salina Cruz, Mexico, June 13, and was included in the high seas bulletin beginning 0600 on the 14th. The center of the squally area was near 12°N, 98°W. Early morning satellite pictures showed more definite development near 13°N, 97°W, at 1200 on the 14th, and a tropical depression bulletin was issued.

ATS-3 pictures showed rapid intensification, during the morning of the 14th, and by 1800 it was apparent that a hurricane was forming. The TURANDOT, at 14°N, 98.2°W, reported 30-kn winds 150 mi south of the center. Winds near the center were estimated at 50 kn.

An early forecast moved the storm west-northwestward, but, by 1930 on the 15th, it was apparent that the storm was taking a more northerly track. The PRESIDENT PIERCE reported an easterly wind of 45 kn at 0000 on the 15th, the first verification that a tropical storm had developed. At 1200, the HU YUNG reported a wind of 5 kn near the center, but gave no indication of having passed through heavy weather during the previous 3 to 6 hr. The RIO CALCHAQUI, about 100 mi east of the center, reported south-south-easterly winds of 45 kn.

At 1800, the STOLT CASTLE reported 40-kn winds; the BRUNSWICK and PANDO POINT reported 50-kn winds. An 1840 Air Force reconnaissance flight into the storm found maximum winds of 62 kn at about 9,875 ft above the sea. The windspeed at near 3,000 m (9,843 ft) has been found to be nearly equal to that on the surface. The eye was reported initially at 15.8°N, 98.9°W, thus relocating the storm center 80 mi north-northeast of its earlier extrapolated position, and changing the direction of movement from northwestward to north-northwestward. The location was later corrected one degree of latitude south due to a communication error, but an onshore movement was still indicated near Acapulco within 24 hr. The storm increased to hurricane intensity by 0000 on the 16th.

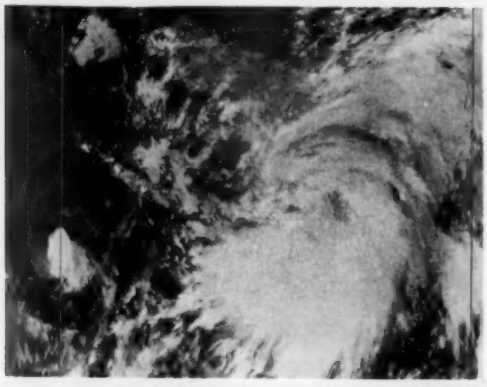

Figure 13.--Hurricane Dolores, June 17, as she moved onshore. Never very pretty, she was responsible for at least 15 deaths -- at least 9 ashore and 6 aboard the yacht PEREGRINE.

The hurricane apparently went onshore, about 1300 on the 16th, about 40 mi southeast of Acapulco. At 1200, the OCEAN HOPE reported an easterly wind of 55 kn, near 16.3°N, 99°W, or 60 mi southeast of Acapulco, but by 1800, all winds along the coast from 95° to 105°W were westerly.

Westerly winds of 25 to 35 kn along the coast continued through 0000 on the 17th (fig. 13), when hurricane advisories on Dolores were discontinued. Strong westerly winds to the west and southwest of Acapulco, and an unidentified vessel report of westerly 50-kn winds, at 15.5°N, 100.3°W, suggested that the hurricane had made a loop and moved offshore to about 40 mi south of Acapulco. This belief was held through 1200 on the 17th. A review of time lapse motion pictures, for the mornings of June 16 and 17, show it is likely that Dolores went onshore on the 16th, and the strong westerly winds with squalls and heavy rains reported by vessels during the night of the 16th were post-hurricane activity.

The heavy rains along the coast caused considerable flooding, washed out highways and bridges, and caused mud slides that took nine lives. News reports indicated another 13 missing several days after the storm moved onshore. The PEREGRINE, a 70-ft North Sea-type trawler with six persons on board, left Acapulco at 1000 June 15 bound for Panama and has been presumed lost.

TROPICAL STORM EILEEN, JULY 1-4

An area of showers, squalls, and thunderstorms near 15°N, 110°W, about 500 mi south of the tip of lower California, began developing June 28. A gradual intensification took place as the area remained nearly stationary. By July 2, a weak tropical storm had formed near 16.1°N, 111°W, but no ships were in the vicinity to verify development. Socorro Island, about 200 mi north of the center, reported east winds at 5 kn.

A slow northward movement was indicated with the center of activity moving to near 17.8°N, 111°W, by 0000 July 3. There the storm moved over cooler water and weakened to a tropical depression. The depression continued to weaken and moved northwestward until 1800 on the 3d, then westward to near 20°N, 115°W at 1800 on the 4th. The last of the cloud formation, after the storm dissipated, was still visible in satellite pictures near 19°N, 114°W, at 2145 on the 5th.

HURRICANE FRANCESCA, JULY 14-19

A telltale cluster of clouds in satellite pictures suggested the seventh tropical cyclone in the eastern North Pacific might be forming near 9°N, 91°W, early on July 12. The cloud mass was followed westward with cyclonic circulation beginning near 11°N, 98°W, about 1800 on the 13th, as indicated by the IRISH CEDAR, ROSE CITY, TRANSMANIC, VOTKINSK, and KFAC, all far enough from the center to experience only light winds and occasional heavy rain.

A more northwesterly track began from near 11°N, 99°W on the 14th, to 15°N, 106°W by the afternoon of the 15th. Intensification to a tropical storm occurred early in the night of the 15th, the storm reaching 50 kn by 0600 on the 16th, while moving northwestward at 10 kn. This course and speed continued until hur-

ricane intensity was reached, at 1800 on the 18th, near 23°N, 114°W.

A westward movement and weakening began as Gretchen (fig. 14) moved into the area from the southwest and south. Francesca was absorbed by Gretchen, near 22.5°N, 119°W, at 1200 on the 19th.

Vessels whose reports helped locate, track, and indicate the storm's intensity were the ALEMANNIA, COPAN, HAMBURG, HANYANG, HEMIFUSUS, HOLTHAV, LYMAN HALL, NORDSTERN, TIJUCA, WESTER, and YAMANASHI.

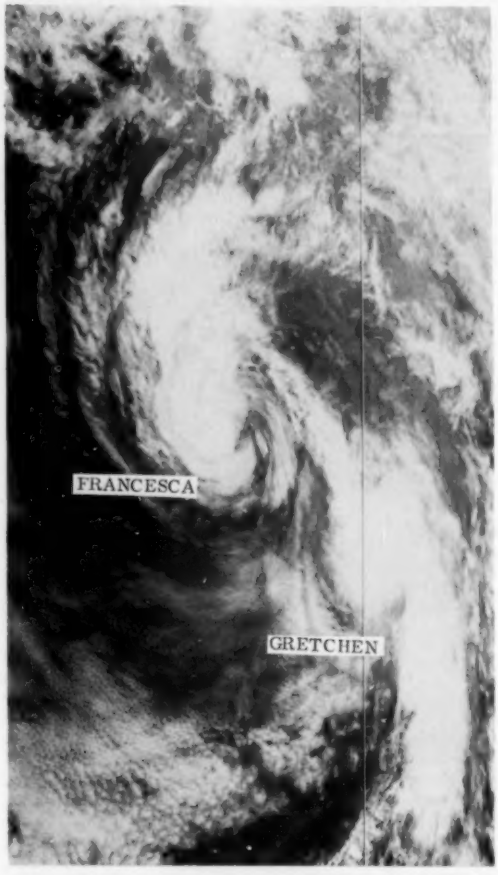

Figure 14. -- Hurricanes Francesca and Gretchen, 1657 July 18. Francesca is at 22.9°N, 114.3°W with 65-kn winds, and Gretchen, at 20.7°N, 111.5°W, with 100-kn winds.

HURRICANE GRETCHEN, JULY 16-21

Every few years two tropical cyclones develop within 600 to 1,000 mi of each other, and an interesting phenomenon occurs. The cyclones tend to rotate around a central point somewhere between the two centers.

Francesca was a developing tropical disturbance near 11°N, 98°W, at 1800 on July 13, as thunderstorms near 11°N, 114°W began to grow in areal coverage and vertical development. They moved westward at 10 kn, then curved toward the north and northeast to near 14°N, 116°W, at 0000 on the 17th. Maximum winds were near 30 kn in this depression.

As Francesca moved northwestward, a band of strong southwesterly winds moved into the area of the depression, and the warm moist air caused gradual intensification to tropical storm Gretchen, by 1200 on the 18th. From 1800 on the 17th to 1800 on the 18th, the intensifying storm traveled 450 mi. Intensification appeared so rapid that an Air Force reconnaissance aircraft enroute to Francesca was requested to search to the southeast and east for Gretchen. After measuring Francesca, the aircraft proceeded to Gretchen at 21.5°N, 111.5°W, and found 85-kn winds 20 mi east of the center, at 1946.

Gretchen curved to the northwest, and then west to 23°N, 119°W, at 0000 on the 20th, while weakening to a tropical storm. It then jogged to the north during the night, and then again westward, dissipating near 25°N, 122°W, at 0000 on the 21st, where the cool water and drier North Pacific air that dissipated Francesca worked on Gretchen as well. Although a circulation continued in satellite pictures for several days, surface winds had apparently returned to normal late on the 20th.

Vessels whose reports were helpful in tracking Gretchen include the CAPISTERIA, CORNELIA MARISK, HOWELL LYKES, KARUKERA, KAWACHI MARU, KISO MARU, MADAM BUTTERFLY, TAEPING, TOKUSEI MARU, and WAWAKUSA MARU.

The strongest wind reported by a vessel was 65 kn by the TAEPING near 19.9°N, 111.5°W, at 1800 on the 18th. No report of damage to vessels was received.

TROPICAL STORM HELGA, AUGUST 9-13

The Intertropical Convergence Zone was quite active near 10°N, from the coast westward, early in August. A number of tropical disturbances formed, but none developed into an organized system until August 9, near 13°N, 109°W. A review of satellite pictures gave no clue as to why this particular area developed more vigorously than the others, and observations from the thinly scattered vessels in the area were not sufficient to help.

The depression was moving on a course of 300° at 8 to 10 kn, a heading and speed it maintained during gradual intensification to tropical storm intensity, at 1800 on the 10th, near 14°N, 114°W. The same course and speed continued to near 16°N, 121°W, at 1800 on the 11th.

Gradual weakening then took place and, by 1800 on the 12th, the tropical storm became a tropical depression. The depression dissipated near 16°N, 124°W, 24 hr later.

The only vessel near Helga was the MEDER LEK, at 1800 on the 10th. She reported a west-southwesterly wind of 20 kn and a pressure of 1008.1 mb, 125 mi east-southeast of the storm. The strongest wind indicated in advisories was 40 kn, and that for only one 6-hr period.

HURRICANE IONE, AUGUST 19-28

During the morning of August 17, satellite pictures showed increased activity on the convergence zone, near 12°N, 114°W. By the end of the day, a disturbance was identified and was tracked westward at 16 kn. The westward speed of the depression slowed to about 10 kn as development took place. It reached tropical storm intensity, near 14°N, 128°W, at 1800 on the 20th.

Tropical storm Ione, with 35-kn winds, curved a little southwestward and weakened to a tropical depression again on the morning of the 22d, and then continued westward to near 12.5°N, 138.5°W, at 1800 on the 23d. Satellite pictures that morning showed that considerable intensification had taken place since the infrared pictures taken the night before, and the depression was raised to hurricane classification with 65-kn winds.

Ione continued intensifying, with 100-kn winds by 0600 on the 24th, as it curved into the Honolulu area of responsibility, near 13°N, 140°W. The hurricane was moving west-northwestward at 10 kn, with winds of 80 to 100 kn. The track slowly curved northward, and, by 1200 on the 26th, Ione was centered near 16.6°N, 144°W. She then moved a little east of north, slowing and weakening rapidly on the 27th: from a hurricane with 70-kn winds at 1200, to a tropical storm with 50-kn winds at 1800, and to a tropical depression with 30-kn winds at 0000 on the 28th.

The MARCONA TRANSPORTER overtook Ione during the period August 22 to 26, passing about 105 mi northwest of the center, at 1800 on the 25th. Maximum winds reported were 30 kn, the highest seas 10 ft, and swells of 16 ft with a period of 14 sec.

HURRICANE JOYCE, AUGUST 22-27

As tropical storm Ione decreased to a depression on the 21st, two disturbances were forming at nearly the same latitude, 600 mi and 1,500 mi to the east. The more interesting of these was near 13°N, 110°W, an area of thunderstorms and squalls in which no center of rotation was apparent from the few peripheral ship reports. After viewing a movie loop of ATS-3 pictures taken on the 21st, it was evident that a circulation had begun near 14°N, 109°W, and it was designated a depression on the 22d. The depression was moving northwestward and slowly intensifying to become tropical storm Joyce, at 1800 on the 22d, near 15°N, 110°W.

The other disturbance developed into a depression, near 14°N, 124°W, at 0600 on the 22d, and at 1800 was increased in intensity to tropical storm Kirsten.

Tropical storm Joyce moved northwestward at 10 kn; increased in intensity to 60 kn at 1800 on the 23d near 17°N, 112°W, to 72 kn at 0000 on the 24th, to 75 kn at 1800 near 18°N, 116°W; and then began a gradual decline.

While Joyce was developing into a hurricane, and midway to tropical storm Kirsten, a tropical depression was forming near 11°N, 117°W. The depression developed rapidly into tropical storm Lorraine, with 35-kn winds near the center. It was moving northwestward at 8 kn.

Back to tropical storm Joyce, with 60-kn winds, she was moving westward at 7 kn near 18.5°N, 119°W, at 0000 on the 26th, when tropical storm Maggie formed near 11.5°N, 105°W, shortly after Ione moved into the central Pacific. Joyce decreased to a tropical storm, near 19.3°N, 124.7°W, at 0600 on the 27th, and by 1800 was a 30-kn tropical depression, rapidly dissipating.

No vessel reported more than 20-kn winds during the life cycle of Joyce, but none reported closer than about 300 mi of the center.

HURRICANE KIRSTEN, AUGUST 22-29

There was a series of tropical depressions and disturbances between 10° and 15°N, from 105° to 135°W, on August 22, and one near 14°N, 124°W was moving northwestward at 15 kn, at 0600. This depression was caught between Ione to the west and Lorraine to the east, and slowed as it intensified to become tropical storm Kirsten, near 15°N, 126°W, at 1800. Further slowing to 8 kn, and intensification to hurricane strength, took place, at 1800 on the 23d, at 16.5°N, 129.7°W. A vessel 120 mi south of the center reported 60-kn winds at that time. At 1200, the tuna boat CABRILLO reported 50-kn winds, 100 mi from the center.

The hurricane was nearly stationary and torn between interacting with Ione to the west and Lorraine to the east. At 1200 on the 25th, she became a tropical storm, near 16.5°N, 131.2°W, and chose Lorraine by heading southeastward. Kirsten weakened to a tropical depression near 14°N, 127°W, at 0000 on the 29th, and special bulletins on her were discontinued.

TROPICAL STORM LORRAINE, AUGUST 23-28

A disturbance developed into a tropical depression near 11°N, 117°W, some 480 mi southwest of Joyce, and 660 mi east-southeast of Kirsten, at 0000 on the 23d. The depression was moving northwestward at about 8 kn, with winds of 30 kn in squalls near the center. Six hours later, satellite pictures indicated it had intensified to tropical storm Lorraine.

The northwestward movement continued through 1200 on the 24th to near 12°N, 121°W, followed by a 10-kn northeastward movement through 1800 on the 26th to near 13°N, 118.5°W. Another jog toward the northwest continued until 17°N, 118.8°W was reached, at 0600 on the 27th, and the storm weakened to a depression. The depression then moved southwestward, weakened, and finally dissipated near 16.6°N, 122.3°W, at 0600 on the 28th.

Vessels whose observations helped locate and track the storm included the CAMERONIA, IWATI MARU, TUGELA, and GZPZ.

HURRICANE MAGGIE, AUGUST 26-SEPTEMBER 1

A disturbed area near 10°N, 105°W, at 1200 on the 25th, became a depression by 1800, as indicated by the USNS SEALIFT, and DELTADRECHT. These reports suggested a closed circulation and a central low pressure. The depression intensified to tropical storm Maggie, at 0000 on the 26th, near 11.5°N, 105°W. Movement was toward the northwest at about 5 kn.

Satellite cameras followed the development to hur-

ricane intensity, at 1800 on the 26th, with 65-kn winds near the center. Further intensification developed winds of 120 kn for an 18-hr period beginning 0600 on the 28th. This was followed by gradual weakening. Air Force reconnaissance aircraft made seven fixes on the storm, reporting windspeeds of 110 kn at 1800 on the 27th (fig. 15), 120 kn at 1800 on the 28th, 115 kn at 0000 on the 29th, 85 kn later on the 29th, and 65 kn on the 30th. Maggie became a tropical storm, at 0400 on the 31st, near 19°N, 116°W, and moved westward at about 10 kn. Weakening continued for another 42 hr until the storm became a depression with 30-kn winds near 20°N, 119°W, at 1800 September 1.

The lowest pressure measured in Maggie was 928 mb. The observer on board the aircraft reported "extremely strong winds from approximately 5 mi from the center into the eye wall." At that time, the eye had a radius of 9 mi and was circular.

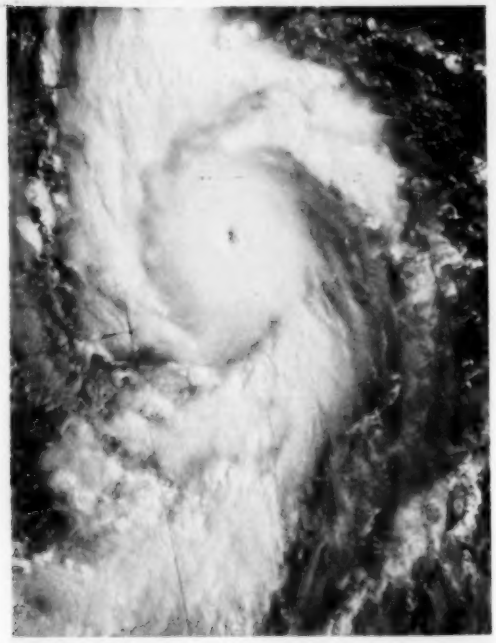

Figure 15.--Looking into the eye of hurricane Maggie, with 110-kn winds near 16°N, 108°W, at 1534 August 27.

HURRICANE NORMA, SEPTEMBER 9-10

Large areas of showers and thunderstorms developed between 10° and 15°N, and from 95° to 112°W, on September 7. The area began breaking into cells on the 8th, and, at 1800, a circulation was indicated by reports from the NANCY LYKES and the RENATTOW, each with 20-kn winds and 1010-mb pressure, about 100 mi north and south, respectively, of the center, which was estimated near 13.5°N, 99°W.

Further organization was slow, but the area developed tropical storm Norma near 15°N, 100°W, before 1800 on the 9th, as indicated by a report from the ANGELBURG, with 40-kn winds and 25-ft seas near 16°N, 100°W. At 0000 on the 10th, the RYUYO MARU reported 40-kn winds, 40 mi north of the center, and the OLGA JACOR reported 45-kn winds, 60 mi to the northeast. At 0211 on the 10th, intensification to hurricane strength was indicated by satellite pictures, near 15.8°N, 100.8°W.

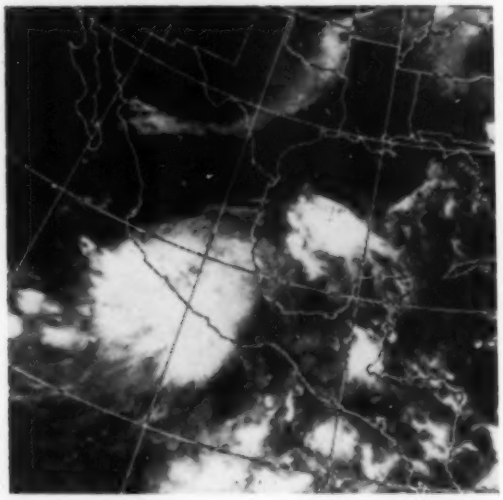

Figure 16.--Hurricane Norma, about 1600 September 10, as she moved onshore. Mud slides caused by heavy rains claimed three lives near Acapulco.

Norma curved north-northwestward at 5 to 8 kn, reaching the coast about 1500 on the 10th, about 60 mi west of Acapulco (fig. 16). Strong southwesterly winds continued for 24 hr in the offshore waters, similar to those after Dolores moved onshore on June 16. The MARITIME ACE reported 35-kn winds and 16-ft swells with 16-ft seas, 200 mi south of Manzanillo, at 1800 on the 10th.

The continued southwesterly flow of moisture brought heavy rains to the mountainous coastal areas, and the resulting earth slides caused at least three deaths in the Acapulco area. No report of damage was received from vessels.

HURRICANE ORLENE, SEPTEMBER 20-24

As the Caribbean hurricane Fifi moved inland over Honduras the night of September 19, a tropical depression was forming near 14°N, 96°W. Winds of 30 to 35 kn were reported by the BUNGA SEROJA, POSTMAR, and 3EZP near the Gulf of Tehuantepec, as the remains of Fifi crossed the Continental Divide. The depression moved northwestward at about 4 kn and joined the upper-air circulation and energy associated with Fifi, which had moved westward at about 20 kn. The merging increased the intensity of both, and tropical storm Orlene was formed with 40-kn winds.

The storm was first reported as having developed over land, but it was located just offshore, at 1200 on

the 21st, about 60 mi east-southeast of Acapulco. Orlene moved northwestward at a speed of 10 kn, nearly paralleling the coast, and slowly increased in intensity (fig. 17). As she crossed latitude 20°N, acceleration began, and the track became a little east of north. Air Force reconnaissance of the storm indicated 59-kn winds, 20 mi east of the center, which was then at 23.4°N, 107.4°W, at 2100 on the 23d. Two hours later, the observer reported that rapid intensification had increased winds to 110 kn, near 23.8°N, 107.4°W.

A short time later, the hurricane moved inland between Culiacan and Mazatlan, Mexico. Heavy rains and gusty winds accompanied the storm inland, but the winds subsided quickly, and no reports of damage were received.

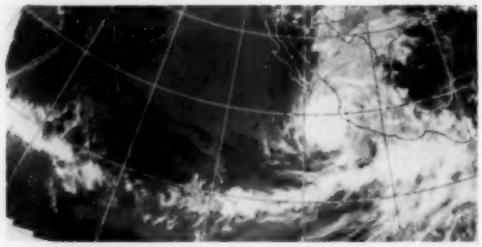

Figure 17.--Tropical storm Orlene, about 0400 September 23, shortly before becoming a hurricane, as she churned her way along the Mexican coast. This NOAA-2 satellite composite picture nicely shows the ITCZ (15°N, 92°W, to 9°N, 120°W).

HURRICANE PATRICIA, OCTOBER 6-17

A westward development of a disturbance was noticed late on October 4, near 10°N, 93°W. Between 1500 and 2200, the disturbance became better formed between 96° and 100°W. Definite organization was noticed in the early morning pictures on the 6th, near 10.4°N, 102.4°W, and development to tropical storm intensity occurred by 0000 on the 7th, near 10.6°N, 104.4°W, with maximum winds of 35 kn. The storm was then moving west-northwestward at 7 to 10 kn.

Further development to hurricane intensity occurred, by 1800 on the 7th, near 12.3°N, 108.5°W. The TACOMA CITY passed 130 mi south of the hurricane, on the 10th, but did not report winds greater than 20 kn, when Patricia had 80-kn winds near her center. The BRANSFIELD passed a few miles north of the hurricane, during the night of the 9th, but no 0600 or 1200 observations were received, and by 1800, she was well west of the center.

Gradual weakening began during the night of the 10th (fig. 18), and the hurricane turned southwestward, with forward motion slowing to about 6 kn. Patricia was downgraded to a tropical storm at 1200 on the 11th, and to a depression at 0600 on the 12th, near 16°N, 123.8°W. It was moving westward and increasing in speed to about 10 to 12 kn. Further weakening was indicated, and bulletins were discontinued at 1200 on the 13th. Satellite pictures indicated the remaining cloudiness moved northwestward to 18.5°N, 130°W, by 0000 on the 14th, and then southwestward again to 16.5°N, 134°W, by 0000 on the 15th.

At 0000 on the 15th, the TROLL RIVER reported southerly winds of 30 kn, and the TRANSCOLUMBIA reported southeasterly winds of 25 kn, 100 mi north of the center. The distrubance continued westward through 0000 on the 17th, to 17°N, 143°W, where it entered the easterly trades and was lost.

TROPICAL STORM ROSALIE, OCTOBER 20-24

Tropical storm Rosalie would not have been observed if it were not for meteorological satellites. The storm formed near 15°N, 133°W, at 1800 October 20, and moved westward and southwestward, averaging 5 kn, through 1800 on the 23d.

The nearest encounter with shipping was with the MEXICAN GULF, at 0000 on the 22d, while she was headed west at 14.6°N, 130.5°W, and tropical storm Rosalie was some 200 mi farther west. The MEXICAN GULF altered her course to the northwest for 24 hr and passed 300 mi north of the center in nearly normal northeasterly tradewinds.

No other vessel reported from the storm area. Maximum winds indicated by satellite pictures were about 55 kn, between 1200 and 1800 on the 21st.

Figure 18.--Hurricane Patricia shortly after maximum intensity, with winds of 75 kn, October 10.

Hints to the Observer

PRESENT AND PAST WEATHER

The present and past weather conditions reported in columns 12 and 13 on the "Ship's Weather Observations" are a very important part of the observation. They give the analyst and forecaster an indication of the type and severity of the meteorological situation through which the ship is passing. For example--a high wind that the forecaster might consider a transmission error becomes real, valuable, and reliable information when combined with a weather report of squalls or thunderstorms. Continuous steady precipitation and/or fog would mean a more stable condition. Past weather and weather within the past hour could help to locate better a front or trough line.

Atmospheric phenomena which are occurring at the time of the observation, or have occurred during the past hour, are considered "Present Weather." The code is so arranged that the higher numbers refer to the more severe weather. The first half of the code, 00 to 49, means that no precipitation is occurring at the time of the observation; 50 to 99 means that hydrometeors are present. Table 5-3 of the "Weather Service Observing Handbook No. 1, Marine Surface Observations" is very helpful.

"Past Weather" fills in the important weather events that have occurred between standard observations, generally the past 6 hr. When more than one past weather code applies, the highest applicable code which is not represented in the present weather code is selected.

Use of "Remarks," Column 40, can be invaluable for recording wind shifts, gusts, extreme winds or waves, pressure changes, and, usually, the time of occurrence.

With winter storms and the forthcoming iceberg and tropical cyclone seasons, a review of Appendix I of the Handbook might be in order.

Tips to the Radio Officer

Warren D. Hight
National Weather Service, NOAA
Silver Spring, Md.

CORRECTIONS TO PUBLICATION, WORLDWIDE MARINE WEATHER BROADCASTS

Pages 16 & 17 -- Norfolk, Va. (NAM): In note which lists lightstation reports in Part 4, delete all references to those stations. They have been replaced by automated lightstations which do not report weather.

Page 47--Adak, Alaska (NMJ 21): Amend times of broadcast to read "0030, 0530, 1340, 1730."

Page 48--Attu, Alaska (NMJ 22): Amend times of broadcast to read "0045, 0545, 1350, 1745."

Page 48--Cape Sarichef, Alaska (NRW): Amend times of broadcast to read "0015, 0515, 1310, 1715."

Page 48--Kodiak, Alaska (NOJ): Opposite 2670 kHz, change broadcast times to read "0200, 0445, 0900, 1415, 1645, 2100."

Page 60--San Diego (La Jolla), Calif. (WWD): Change Footnote 2 to read "Broadcast June 15 - October 15, Monday - Friday."

Page 60--Honolulu (Kahuku), Hawaii (KHK): The information in the January 1975 "Tips," stating that scheduled broadcasts have been canceled, was not correct. The schedule remains 0530 and 2030 GMT; however, only warnings are transmitted. In addition, change the Area description to read "(a) North Pacific: Equator-50°N, 140°W-160°E; (b) South Pacific: Equator - 25°S, 110°W - 160°E."

ACKNOWLEDGEMENT OF CORRESPONDENCE

We want to thank the following officers for their useful comments and information:

W. Findlay, Radio Officer, EXXON BANGOR
P. Martin, Radio Officer, PATONGA
C.H.E.J. van der Ploeg, KEMBLA
Mario R. Benjamin, Radio Electronics Officer, PRESIDENT FILLMORE
Santos M. Pucan, Master, PRESIDENT QUEZON

Photo courtesy of Australian News and Information Bureau.

Wide World Photo.

Photo courtesy of Australian News and Information Bureau.

Hurricane Alley

DARWIN BEFORE AND AFTER TRACY: Rebuilt since World War II, the "Top End's" only city (upper left) has an Asiatic flavor, being as close to Singapore as to Sydney. It is a city of modern office complexes and a lot of small iron-roofed stores, both of which took a beating (lower left). Bungalows are the most common form of housing, and as many as 9,000 were destroyed or extensively damaged (upper right). Many of Darwin's homes are built on pilings, which allows for air circulation, but makes them prone to wind damage (lower right). Damage was estimated at $400 million (Australian dollars).

Wide World Photo.

Hurricane Alley

Dick DeAngelis
Environmental Data Service, NOAA
Washington, D.C.

TROPICAL CYCLONE TRACY

Darwin is a friendly town; a comfortable, fun-loving town. It is easy to imagine the Christmas spirit that prevails there during the holiday season. It is hard to grasp the suddenness with which tropical cyclone Tracy changed that spirit this past season. Happiness turned to despair. Homecoming became evacuation. The sound of church bells gave way to the sound of sirens. Survival was the most precious gift. Forty-nine people lost their lives.

The full force of severe cyclone Tracy hit Darwin, Australia, early Christmas morning. Sustained winds reached 108 kn and gusted to 140 kn before the anemometer blew down. Shortly after 0300 LST, the eye of the storm passed over Darwin Airport. Pressure fell to 950 mb--a drop of 23 mb in 1 hr. Torrential rains triggered heavy flooding. The rain and wind finally began to subside around 0700 LST.

Tracy was first detected, on the 20th, about 380 mi northeast of Darwin. She became a named tropical storm on the 22d after moving southwestward. Early on the 23d, as Tracy rounded Bathurst Island, the automatic weather station at Cape Fourcroy registered gusts to 65 kn. The following morning, she was a small, but powerful, hurricane; gales extended out to less than 50 mi. Tracy turned east-southeastward. The Northern Territory's Tropical Cyclone Warning Center promptly issued Christmas Eve warnings for Darwin.

Southern Hemisphere tropical cyclones aren't unusual at this time of the year. However, they don't often reach the intensity of Tracy. The last severe cyclone to hit Darwin occurred in 1937. The tropical cyclone season coincides with the "Wet." This is the "Top End's" rainy season, which lasts from about November through March. During this season it is hot, humid, and rainy. Much of the coastal region is a swamp. The "Dry" is at the other extreme. From about May through September, desert-like conditions prevail--hot, dry, and dusty.

Tracy was the only December tropical cyclone in any of the three basins--the North Indian, South Indian, and South Pacific. This was below-normal activity since an average of two usually form in the South Pacific-Australia region, and one each in the North and South Indian Oceans. However, in November one formed in each region, which is a little above average.

Figures 19 and 20 show the tracks of these storms. These are preliminary tracks based on satellite information.

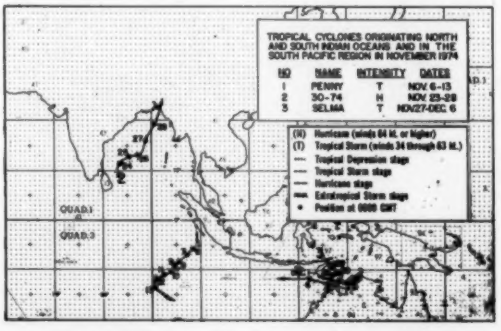
TROPICAL CYCLONES ORIGINATING NORTH AND SOUTH INDIAN OCEANS AND IN THE SOUTH PACIFIC REGION IN NOVEMBER 1974
NO NAME INTENSITY DATES
1 PENNY T NOV 6-13
2 30-74 H NOV 23-28
3 SELMA T NOV27-DEC 6
QUAD 1
QUAD 3

Figure 19.--Tracks of tropical cyclones, North and South Indian and South Pacific Oceans, November 1974.

SOUTH INDIAN OCEAN

The Intertropical Convergence Zone spawned a tropical depression on November 6. She reached tropical storm strength and was christened Penny that same day. Penny moved slowly southwestward. Winds near her center blew at 35 to 40 kn for the next several days. On the 12th, west of the Cocos Islands, she began to recurve toward the southeast. The following day maximum sustained winds were down to 20 kn near an ill-defined center.

NORTH INDIAN OCEAN

A 10-ft storm tide accompanied by the strong winds of a late November tropical cyclone wreaked havoc on the vulnerable coast of Bangladesh. However, less than 100 people lost their lives; thousands of others were left homeless. Winds and waves also swept over several offshore islands.

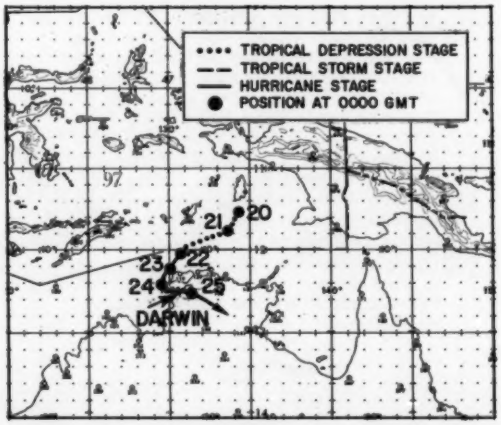

Figure 20.--Track of killer storm Tracy, December 1974.

The storm formed on the 24th in an area favored for tropical cyclone development during this peak month of activity. The tropical storm moved northeastward as it intensified. Maximum sustained winds climbed to about 60 kn near the storm's center, on the 26th. Early on the 28th (fig. 21), Sandheads, some 200 mi to the northwest of the eye, reported 40-kn winds from the north-northeast. The storm moved inland just north of Chittagong, late on the 28th.

SOUTH PACIFIC REGION

A tropical depression came to life just north of Timor on November 27. She wasn't much of a storm as she meandered southward until the end of the month. On December 1, she became tropical storm Selma. Selma turned eastward and decided to take her 40-kn winds to Darwin. She crossed the coast on the 3d, weakened to a depression, and turned back into the Joseph Bonaparte Gulf. She hung on for a few more days, but was soon forgotten three weeks later.

Figure 21.--This November tropical cyclone brings unwanted rain to Bangladesh, on the 28th. The country had been plagued by rains and flooding from the monsoon.

On the Editor's Desk

CHANGE IN ABBREVIATION FOR KNOTS

Starting with this issue, the abbreviation for speed in knots will be "kn," rather than "kt," as this is the recommended style for government publications. The old style will still be found in some of the narratives and listings until the format can be changed.

FIVE U.S. COAST GUARD RADIO STATIONS ACCEPT WEATHER AND AMVER REPORTS ON VOICE FREQUENCIES

Five U.S. Coast Guard radio stations are accepting AMVER and METEO traffic over voice frequencies. The appropriate carrier and assigned frequencies for ship and coast stations are listed below. The National Weather Service is asking the assistance of vessels without radio officers to take weather observations on a regular basis. NOAA Form 72-5b and instructions for making and transmitting observations may be obtained from any Port Meteorological Officer. Addresses are given on the back cover.

Guard Period	SHIP STATIONS Carrier Frequency	SHIP STATIONS Assigned Frequency	COAST STATIONS Carrier Frequency	COAST STATIONS Assigned Frequency
	Washington/NMH and New Orleans/NMG			
24 hr	4094.8 kHz	4096.2 kHz	4393.4 kHz	4394.8 kHz
24 hr	6207.2 kHz	6208.6 kHz	6521.8 kHz	6523.2 kHz
24 hr	8226.8 kHz	8228.2 kHz	8760.8 kHz	8762.2 kHz
	San Francisco/NMC and Honolulu/NMO			
24 hr	4094.8 kHz	4096.2 kHz	4393.4 kHz	4394.8 kHz
24 hr	6207.2 kHz	6208.6 kHz	6521.8 kHz	6523.2 kHz
24 hr	8226.8 kHz	8228.2 kHz	8760.8 kHz	8762.2 kHz
Upon request	12365.0 kHz	12366.4 kHz	13144.0 kHz	13145.4 kHz
Upon request	16495.0 kHz	16496.4 kHz	17290.0 kHz	17291.4 kHz
	Kodiak/NOJ			
24 hr	6207.2 kHz	6208.6 kHz	6521.8 kHz	6523.2 kHz

NASA TO STUDY OCEAN FEATURES FROM SPACECRAFT

Sea Satellite (SEASAT), a new program for monitoring the oceans to provide continuously updated reports on weather and sea conditions, has been announced by NASA. Responsibility for managing the 954-kg (2,100-lb) spacecraft, which will circle the Earth 14 times a day in a north-south orbit, has been assigned to the Jet Propulsion Laboratory (JPL) in Pasadena, Calif.

Instrumentation in a sensor module, which forms a part of the satellite, will provide data from which wave heights, current directions, surface wind directions, and surface temperatures can be determined. These data will allow for the recognition of storms, sea state, currents, ice fields, and specific weather conditions. As currently planned, the module would consist of four primary sensors: a compressed pulse radar altimeter, a coherent synthetic aperture imaging radar, a microwave wind scatterometer, and an infrared radiometer.

The launch in 1978 of SEASAT-A will be a proof-of-concept mission, which could lead to operational missions in later years. The concept of such a satellite has evolved since 1973 in cooperation with other government agencies and private institutions interested in, and knowledgeable about, the oceans. The objective of the initial mission will be to demonstrate the capability of continuously acquiring a wide variety of accurate oceanic data, and rapidly disseminating that information to users concerned with weather predictions, routing of shipping to avoid storms, adverse currents and ice fields, and coastal disaster warnings.

An operational network of satellites could provide individual ships at sea with twice-daily detailed maps of their specific route, noting weather conditions, sea state, and hazards. In addition to immediate applications of satellite data to such uses as hazard and storm warnings, SEASAT will also accumulate sci-

entific data on the curvature of the oceans; ocean circulation; transport of mass, heat, and nutrients by surface currents; and the interaction between air and sea.

The approximately one-ton satellite will be supported by aircraft, ships, and buoys to verify measurements reported from space. It will orbit the Earth in an 800-km (480-mi) orbit inclined 108°.

In establishing the requirements of the satellite system, and to carefully define the types of information that would be of practical use, NASA was supported by a SEASAT User Working Group composed of representatives from the Departments of Commerce, Defense, and Transportation; the National Academy of Sciences; the National Science Foundation; the Smithsonian Institution's Astrophysical Observatory; the Woods Hole Oceanographic Institute, Mass.; Scripps Institute of Oceanography, Calif.; City University of New York; and several commercial users.

UPPER LAKES SHIP SEASON RECORD SET

The bulk carrier ROGER BLOUGH sailed through the Poe Lock at Sault Ste Marie, in -23°C weather, on February 10. In so doing, she made the 1974-75 shipping season the longest one ever on the upper Great Lakes. The previous season-length record was February 8. Extension of the navigation season beyond the traditional mid-December closing is part of the demonstration program inaugurated to determine the feasibility of keeping the Great Lakes open to shipping far into the winter, and possibly all year.

Winter temperatures in the region so far this year have been above normal. The forecast for the Soo area predicts normal temperatures (-9° to -18°C) for the remainder of February.

SURVEY OF USERS OF WWV, WWVH SERVICES

The National Bureau of Standards is conducting a survey of the users of WWV and WWVH. They are interested in the station and frequencies used, how often used, importance to your operation, what information is used and its importance (such as time of day, one-second ticks, standard frequency, weather, etc.), signal strength, principal use, and your association (military, individual, university, industry, etc.).

Your comments on the above categories will be appreciated and should be sent to: National Bureau of Standards, Time and Frequency Division, Boulder, Colo. 80302. Or, if desired, the NBS Questionnaire (OMB No. 41-S74125) itself may be obtained from the above address.

CASUALTIES ABOARD U.S. COMMERCIAL VESSELS

A total of 5,413 ships were involved in 3,388 casualties during the year ending June 30, 1974, according to a tabulation contained in a recent issue of the Proceedings of the Marine Safety Council. Storms or adverse weather were the primary cause of 292 of the 5,413 individual casualties, and unusual currents were the primary cause of 45 of these casualties. There were 199 deaths and 104 injuries as a result of 144 ship casualties; two of these casualties were the result of collisions in fog, resulting in one injury. Capsizings, founderings, and floodings constitute the category resulting in the highest number of casualties, 51, with 112 deaths and 5 injuries. Of the 144 casualties causing deaths and injuries, storms or adverse weather were the prime cause of 22.

In addition to the above deaths and injuries, there were 286 deaths and 1,265 injuries aboard ships not involved in ship casualties. Natural causes accounted for 108 of these deaths; 98 persons fell overboard and drowned, and only 6 deaths were primarily attributed to weather conditions (3 fell overboard). Sixty-eight of the injuries were a direct result of weather.

Casualties involving commercial vessels are required to be reported to the U.S. Coast Guard whenever the casualty results in 1) actual physical damage to property in excess of $1,500, 2) material damage affecting the seaworthiness or efficiency of a vessel, 3) stranding or grounding, 4) loss of life, and 5) injury causing any person to remain incapacitated for a period in excess of 72 hr, except injury to harbor workers not resulting in death and not resulting from vessel casualty or vessel equipment casualty.

AIRBORNE SEARCHLIGHTS REPLACE FLARES

Powerful superlights which can illuminate the earth five times brighter than full moonlight are being tested for use by Coast Guard aircraft on nighttime search and rescue missions.

During recent wide-area illumination tests conducted at the Elizabeth City, N.C., Coast Guard Air Station, a superlight mounted aboard a C-130 Hercules was turned on at 3,000 ft. The 30-kw light illuminated an area three-quarters of a mile in diameter and enabled persons on the ground to read a newspaper.

A 2-kw version of the light is already in use, replacing the old parachute flares which were both hazardous and expensive to operate. The smaller light has already proven its lifesaving value. It was used by the Coast Guard in a search for a Piper Cherokee aircraft that disappeared in a wooded area of North Carolina during a heavy rainstorm. A Coast Guard HH-52A helicopter was led to the area by a radio homing device, and then used the searchlight to locate the downed plane visually and guide ground parties to the crash survivors.

Priced at about $3,800, the 2-kw light provides a steady, uniform light that is almost as bright as that obtained from the flares and is much safer to operate. The flares are considered dangerous by even the most experienced aircrews and are useless over habitable areas and woodlands because of the danger of starting ground fires.

When flares are used, they are generally dropped from a fixed-wing aircraft, teamed with helicopters. Helicopter crews sometimes spend more time watching for flares which could fall through the rotor system than they do actually searching.

Encouraged by the use of the small xenon light, the Coast Guard borrowed a super xenon searchlight system from the Army Night Visions Laboratory and mounted it on a C-130 for testing purposes. Test flights for the superlight were conducted at altitudes varying up to 3,000 ft, but it may be operated effect-

ively at higher levels.

During tests conducted with the aid of lower-flying helicopters, the superlight proved "far superior to flares in a one aircraft illuminating-one aircraft searching situation." A crewman who had flown search missions using parachute flares said the new superlight is far more effective for water and land search. Crewmen aboard the lower-flying helicopters were able to spot boats at about 2 mi distance.

The Coast Guard hopes to have the superlight in operation in about 6 mo.

SATELLITE, SHIP VERIFY WAVE THEORY

A sailing schooner joined forces this past summer with a satellite and an aircraft in an oceanographic experiment conducted by NOAA which verified that striations seen on the ocean's surface from space are actually surface signs of deep underwater internal waves. (See page 248 of the July 1974, Vol. 18, No. 4 issue of the Mariners Weather Log.)

Internal waves and their accompanying surface slicks have long been studied by oceanographers because of their importance in oceanic mixing processes and in modifying underwater sound propagation, and because they may be a source of the slowing down of the earth's rotation.

Dr. John Apel, Director of the Ocean Remote Sensing Laboratory, and a colleague, Robert Charnell, first spotted the striations on images made from the NASA Earth Resources Technology Satellite (ERTS-1), over the continental shelf off New York. From characteristics observed on images taken during the first year after the launch of ERTS-1, it was deduced that the striations were probably due to very long, slow-moving internal waves traveling under the surface of the sea. The underwater waves appeared to be generated at the edge of the continental shelf by tides during late spring through fall, when solar heating causes a layer of warm, light water to overlie the colder, denser water below. A narrow strip of smooth surface water is created over a portion of each wave, which then propagates along and serves as an identification tag for the underlying oscillation during calm conditions.

The research vessel WESTWARD, a 100-ft staysail schooner (fig. 22), was chartered for a 6-wk New York-to-Bermuda scientific voyage during June and July of last year to verify the existence of the underwater waves. The WESTWARD was selected because the scientists felt one of their new observational instruments, an acoustic echo sounder, would function much more sensitively in the quiet environment of a sailing vessel.

To carry out the experiment, the WESTWARD moved synchronously with several ERTS-1 overpasses during two 18-day periods while NASA gathered data from the satellite. In addition, a NASA U-2 aircraft (cover), flying at 65,000 ft over the New York Bight between Sandy Hook and the Hudson Canyon, tested the Goddard Space Flight Center's coastal zone color scanner in conjunction with the WESTWARD on two other days.

The Miami research team correlated the ERTS, U-2, and surface camera imagery with subsurface measurements of internal waves taken aboard the sailing vessel using thermistors, bathythermographs, acoustic echo soundings, and salinity temperature and depth probes. The resulting data verified that the surface slicks did have underlying internal wave motion associated with them, and that the slicks were the objects being seen in spacecraft and aircraft photographs.

Figure 22.--Displaying full canvas, the WESTWARD is a fine sight to behold.

NOAA SHIPS SEARCH FOR SUNKEN WRECKS ALONG AMERICA'S COASTS

A 3-mo search began in February for 20 sunken wrecks which lie off the Atlantic coast between Chesapeake Bay and the Florida Keys, and along the Florida west coast. The wrecks are but a few of the hundreds of ships which have sunk over the years, victims of storms and accidents at sea. The ones being sought are reported to be navigational hazards in that their water-ravaged hulks or superstructures may lie so close to the surface that they pose a danger to passing vessels.

The search is being made by the 190-ton, 90-ft sister ships RUDE and HECK, part of the NOAA fleet of 25 vessels which engages in various types of ocean surveys and research.

The general locations of the wrecks have been reported to the National Ocean Survey. The task of the RUDE and HECK is to determine their exact locations and the depth of the water above them. They do so by dragging a steel wire between them as they conduct their search. When the wire gets hung on a wreck, scuba divers from the ships examine the wreck and measure the water's depth. Its location is then noted on a nautical chart.

Of the 20 sunken vessels, 5 are located at the entrance to Chesapeake Bay, an expanse of often stormy water through which ships journey to Virginia and Maryland ports. These are first on the schedule of the wire drag ships, and the search is expected to take about 6 wk. The two ships will next proceed to the coasts of North and South Carolina, where six wrecks have been reported as possible navigational hazards.

In the Florida Keys and east coast search, seven wrecks, plus a reported dangerous coral formation with a clearance of only 14 ft in 35-ft depths, will be investigated. The coral is only one of a number of unidentified "obstructions," including shoals, dangerous rocks, and debris, which have been dumped into the sea and may now pose a danger to shipping and recreational craft. After completing their work in the Florida Keys, the ships will investigate two reported wrecks off the Florida west coast.

Although the wrecks have not been identified, the majority appear to be fishing vessels. They include, however, a World War II Liberty ship and a pontoon section of a floating drydock. This wreck has been labeled dangerous to navigation, as have five other sunken vessels which are being sought.

NEW ORLEANS, MISSISSIPPI DELTA AREA STORM EVACUATION MAPS TO BE PUBLISHED

Seven storm evacuation maps will be published early this year for New Orleans and the Mississippi River Delta. The small-scale maps, designed to facilitate evacuation of people from endangered areas, are part of a series of 180 maps being published by the National Ocean Survey for Atlantic and Gulf coast areas subject to flooding from hurricane and other high waters. Thirty-one have already been issued.

The new storm evacuation maps will cover New Orleans and the Mississippi River from about 25 mi west of New Orleans southeast to the Mississippi Delta, Lake Pontchartrain, and part of Lake Borgne. Within the area are parts of the parishes of Jefferson, Lafourche, Livingston, Orleans, Plaquemines, St. Bernard, St. Charles, St. John the Baptist, St. Tammany, Tangipahoa, and Terrebonne. In addition, numerous small communities will be shown, including Ponchatoula, Laplace, Grand Isle, Chef Menteur, and Buras.

The maps, which show emergency evacuation routes, areas subject to flooding, and elevations which might afford "safety islands" for storm evacuees, are distributed to state and local officials and community emergency preparedness committees by the National Weather Service. They are available also to the public for $2 each from the National Ocean Survey Distribution Division (C44), Riverdale, Md. 20840.

To date, maps have been issued for three Gulf coast areas--New Orleans to Mobile, Ala., Galveston to Houston, Tex., and Corpus Christi, Tex.; the Atlantic coast from Charleston, S.C., to Savannah, Ga.; the Greater Tidewater area of Virginia, including Norfolk; and New York-New Jersey coastal areas, including all of Long Island.

PMO SHIP VISITATIONS DURING 1974

National Weather Service Port Meteorological Officers (PMOs) made 9,099 ship visits during 1974, an increase of 3 percent over 1973. During the year, PMOs recruited 447 new ships and dropped 350 inactive or decommissioned ships from the United States-managed Cooperative Ship Program.

The current trend in high seas shipping is to utilize fewer, but larger and faster, ships that dock at terminals widely dispersed throughout port cities. PMOs must now travel farther and faster to reach and service the same number of ships they used to. This problem is further aggravated by travel restrictions imposed on PMOs by the energy crises. The increase in the overall number of ship visitations during 1974 is due in no small part to the conscientious efforts of all PMOs in overcoming these problems.

NEW BUOY ANCHORED IN ATLANTIC

A new 100-ton environmental buoy has been anchored in the Atlantic Ocean about 125 mi east of Norfolk, Va. It will keep tabs on ocean-spawned storms that could endanger the mid-Atlantic states and New England.

The new automatic data-reporting buoy, EB-01, was towed from Gulfport, Miss., by the Coast Guard Cutter ACUSHNET, and deployed by NOAA in the Gulf Stream in 9,900 ft of water.

The buoy is one of four large data buoys off the Atlantic coast and in the Gulf of Mexico and the Gulf of Alaska that provide environmental data from the deep ocean. It replaces an earlier buoy which ceased operations last March after almost 4 yr of reporting data required by meteorologists for their daily weather forecasts, and for warnings of hurricanes and winter storms.

Environmental data is transmitted from EB-01 every 3 hr to a Coast Guard station in Miami, Fla., from there to the National Weather Service, and finally to other users via national and international net-

works. The buoy is capable of more frequent interrogation on request when needed for following closely the development of storms moving onto the coast.

The sensors on the data buoys measure oceanic and atmospheric data, including windspeed and direction, rainfall, air temperature and pressure, dewpoint and surface water temperature, and conductivity. EB-01 also has a wave measurement system designed to give wave heights and period. The sensors are activated automatically or on signal from shore via a small computer aboard each buoy. The large buoys are designed to withstand 150-kn hurricane winds, 60-ft waves, and 10-kn currents. High-frequency communication with the buoys is provided by the Coast Guard, which also furnishes necessary ship-servicing support for the buoys at sea.

NOAA SCIENTISTS REPORT ON CLOSEST LOOK YET AT TORNADO LIFE CYCLE, WINDS

On May 24, 1973, a large tornado twisted to earth near Union City, Okla., ripped its way through the tiny community (population 500), and died over the prairie west of Oklahoma City (fig. 23).

What made the Union City tornado different, besides its above-average size, was that its entire life cycle was filmed at close range by a team of storm-chasing meteorologists from NOAA. The result of their windy day's work is man's best look thus far at the birth, life, and death of one of nature's most destructive phenomena, and the first measurements ever made of tornado windspeeds at different times in the life of the twister.

Joseph H. Golden and D. W. Purcell, both with the National Severe Storms Laboratory in Norman, Okla., presented the results of more than a year's analysis of Union City tornado data at the American Geophysical Union meeting in December 1974 at San Francisco, Calif. For several years it has been suspected that tornado winds are probably not much more than about 200 mph. This work points in that direction.

Photogrammetric analysis of the Union City footage, done by tracking from frame to frame easily identifiable cloud "tags" and debris outside the funnel proper showed the following distribution of winds. Maximum windspeeds of from 140 to 185 mph were observed in the large debris cloud about 300 ft above the ground, and extended outward from the funnel walls

Figure 23. -- The tornado, which is probably the most destructive force on earth for its size, appears to be roaring down on the vehicles on the highway.

from 650 to 820 ft. At the same time, cloud tags rotating around the upper periphery of the tornado funnel had horizontal windspeeds of 10 to 100 mph at distances of from 1,300 to 2,300 ft from the tornado's center. Calculations of vertical windspeeds indicated upward motion in the debris cloud of about 30 to 70 mph below 330-ft heights, and 23 to 35 mph in a "feeder band"--a cloud spiral running from the upper portion of the funnel into the larger, parent circulation in the tornado-spawning thunderstorm. These findings are similar to the only other photogrammetric tornado wind measurements, those made from newsfilms of a Dallas tornado 14 yr ago.

One surprising finding was that there was no correlation between the width of the tornado and the severity of the damage along the path of the funnel. That is, although when large, the tornado caused damage along a wider path, the severity of the damage seemed to stay about the same. The tornado funnel diameter ranged from 300 to 1,600 ft near the top. As it entered the town, the funnel shrank rapidly in diameter at all heights, its top tilted much more toward the northeast, and the tornado turned suddenly to the southeast, accelerating to a forward speed of 20 to 25 mph. However, the maximum winds observed did not change very much with this shrinking, and the damage along the narrower path of the storm was still quite severe.

In fact, severe damage was the hallmark of the Union City tornado. Golden and his colleagues found that the storm was picking up and hurling automobile-sized missiles for hundreds of feet, and that structures were more than destroyed--the twister swept the foundations clean of debris as well. Even after the storm had contracted, it was able to do that kind of damage along its narrower track. A large frame house southeast of Union City was completely destroyed and its foundation swept clear of all the pieces.

The Union City tornado study also indicates that tornadoes and another, less violent atmospheric whirlwind--the Florida waterspout--may share similar life cycles. In many tornadoes, before a funnel cloud is seen, the storm beginning is seen as a kind of oversized dust devil at the surface. This corresponds to the dark spot seen on the ocean surface before waterspout funnels form. There are also similarities in the mature and decay stages. Usually a waterspout decays abruptly as an advancing rainshower overtakes it from the rear. In the Union City tornado, heavy rain and hail to the north began to overtake the funnel, which became contorted and ropelike, and then dissipated rapidly. This suggests that the tamer waterspout would be an extremely valuable "surrogate" tornado for severe storm researchers.

CIVIL WAR VESSEL SITE NAMED NATIONAL MEMORIAL

The wreck of the famous Civil War gunboat USS MONITOR, and the ocean area where she rests off Cape Hatteras, N.C., were designated in January as the Nation's first Marine Sanctuary. The designation came exactly 113 years after the launching of the vessel. It had been nominated as a Marine Sanctuary last September (Mariners Weather Log, Vol. 18, No. 6, page 384).

The designation means that the remains of the MONITOR will be protected from treasure hunters or would-be salvagers, as a symbol of Americana. The wreckage site may also become a major laboratory for archaeological research. The ship's remains lie upside down in 220 ft of water about 16 mi off Cape Hatteras. The site will be marked on all new nautical charts, and activities within the one-square-mile sanctuary will be controlled by NOAA's Office of Coastal Zone Management. Activities such as dredging, diving, anchoring, laying of cable, and trawling will be prohibited.

During designation ceremonies at the Department of Commerce, in Washington, D.C., Secretary Frederick B. Dent noted the contribution the MONITOR had made to the historic and technological heritage of the country. Best known for her battle with the Confederate ship MERRIMACK, the MONITOR, when it was commissioned in 1862, also represented a break from standard naval design, symbolizing the end of the wooden warship and the beginning of the modern capital ship.

Launched on January 30, 1862, the MONITOR was designed from the start to battle the Confederate ironclad VIRGINIA. Originally a U.S. Navy wooden steam frigate commissioned as the USS MERRIMACK, this ship was taken by the South, her wooden hull clad in iron plates, and her topside completely remodeled and also sheathed in iron. Recommissioned the VIRGINIA, she was terrorizing the Union fleet, sinking a number of wooden fighting ships through a combination of shelling and ramming them. In response to this threat, which some Union leaders saw as potentially winning the war for the South, the MONITOR was built in 101 days at a Brooklyn, N.Y., shipyard, and was hurriedly dispatched to Hampton Roads to engage the MERRIMACK/VIRGINIA.

On March 9, 1862, the famous 4-hr battle was joined, the two ships hammering at one another, often at point-blank range. Then the MERRIMACK, leaking and short on ammunition, retreated back into Norfolk, Va. Naval historians consider the battle a draw.

For the next several months, the MONITOR remained in the area, and although the Confederate ship reappeared several times, the two vessels never rejoined action. In May, Norfolk was taken by Union forces and the MERRIMACK was burned and scuttled.

The MONITOR continued on-station off Hampton Roads until Christmas Day, when she was ordered to proceed southward under tow to Beaufort, N.C., preparatory to joining an attack on Fort Fisher, N.C. Late in the evening of December 30, 1862, as the MONITOR and her tow ship, the USS RHODE ISLAND, were off Cape Hatteras, fighting their way through a violent storm, the MONITOR began to take on water. For the next few terror-filled hours, the crew fought to save their ship, but, about midnight, "abandon ship" was ordered. All but 16 of her crew of about 40 officers and men were rescued before the MONITOR, at 1 a.m. on the final day of the year of her birth, slipped beneath the surface and sank.

For more than 100 yr, the precise location of the wreckage remained unknown. But, in August 1973, a group of marine scientists using underwater cameras and other electronic apparatus found the remains. Early last year, a more elaborately equipped expedition confirmed the earlier find, obtaining hundreds of photographs of the wreckage and eliminating all doubt that it was, indeed, the MONITOR.

LETTERS TO THE EDITOR

THE SINKING OF THE JENNIFER

The following account of the sinking of the 210-ft Canadian cargo ship JENNIFER on Lake Michigan, on December 1, 1974, was written by William E. Kennedy, Port Meteorological Officer, Cleveland, Ohio.

"Gale warnings were up on the southern half of Lake Michigan from Manitowoc-Pentwater southward (fig. 24). The forecast called for easterly winds 28 to 33 kn occasionally shifting to the northeast and increasing to 34 to 40 kn. Snow was also forecast for all of Saturday night and Sunday, November 30 and December 1. Waves of 4 to 8 ft were forecast. A small ship only 210 ft long, the Canadian cargo ship JENNIFER (fig. 25) was headed for the Port of Milwaukee with a load of steel pilings and beams. The vessel was just 38 mi from Milwaukee, 21 mi south-southeast of Sheboygan, and 21 mi east-northeast of Port Washington. The time was about Saturday midnight (0600 December 1, 1974) when the pounding waves caused the load to shift to the starboard and the vessel listed around 22°. A MAYDAY was sent over the ship's radio; the JENNIFER was in trouble. The Coast Guard immediately went into action. Lt. (jg.) Roger Argalas was roused from sleep and told that a ship was in distress. The crews of the USCGC RATITAN berthed in Green Bay, the USCGC MESQUITE berthed in Sturgeon Bay, and the Icebreaker WESTWIND berthed in Milwaukee,

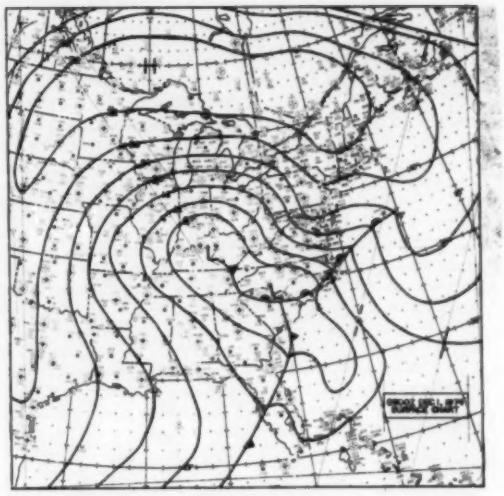

Figure 24.--The synoptic surface weather analysis, for near the time the JENNIFER sank, according to the 0600 December 1, 1974, chart.

Figure 25.--This picture was taken when the JENNIFER was named the CACOUNA. Names mean nothing to the unforgiving waters. Wide World Photo.

were roused and made ready to get underway to rush to the JENNIFER's aid. At Milwaukee a small crew launched a 44-ft lifeboat and headed northeastward to the scene.

"When the MAYDAY was sounded, the British FORTUNA heard the frantic call and headed for the scene. A Spanish ship, the MONTE ZARAYA, also close by, headed for the scene, and an American Great Lakes tanker, the VENUS, turned around and headed for the JENNIFER. The time was now 0948 (0348 CST). The JENNIFER's deck was awash on the starboard side with a 30° list. The vessel was rolling over. The FORTUNA made several attempts to pass a life raft to the crew of the JENNIFER, but with the heavy seas was unable to do so. The VENUS arrived on the scene and turned all search lights on the JENNIFER. She was now listing about 35°.

"A Coast Guard helicopter from Glenview, Ill., arrived on the scene and decided to take some of the men off the sinking vessel. The weather was worsening and the ship was slowly sinking. Aviation Machinist Mate Gerald L. Dautherty lowered a basket from the helicopter and plucked one man from the sinking ship. The basket was lowered three more times; four men were removed in all. The helicopter was now running low on fuel. It turned from the scene and headed for Milwaukee Airport with the four men.

"At 1047 the ship was listing about 45°. The remainder of the crew of 11 men entered a lifeboat and pushed away from the sinking ship. Just 5 min later they watched their ship slide under the waves. The lifeboat headed toward the FORTUNA and the men were taken aboard. No one was injured. Just before the ship sank there were two more helicopters on the scene, another from Coast Guard Air Station, Glenview, Ill., and one from Coast Guard Air Station, Traverse City, Mich. The 44-ft boat that put out from Milwaukee Coast Guard Station was battling the huge waves, and was turned back. The FORTUNA left the scene with the 11 crewmen and dropped them off at Port Huron on Lake Huron.

"This was an outstanding rescue on Lake Michigan, and one of the largest Coast Guard rescues on the Great Lakes. As the Coast Guard pilot Lt. Argalas put it, it was a rather hectic rescue attempt. 'It got pretty frantic out there.' The night was black, some snow was in the air, but visibility was unlimited. Winds were estimated at 20 to 30 kn out of the northeast. Waves were estimated at 8 to 10 ft high. A British ship, a Spanish ship, an American ship, three Coast Guard helicopters, two Coast Guard Cutters, one Coast Guard Icebreaker, and a small 44-ft Coast Guard boat all rushed to the scene. A ship was lost, but the crew was saved -- a rescue that was highly successful."

VICTIMS OF HURRICANE FIFI RESCUED BY MERCHANT VESSELS

This interesting account of the rescue efforts of the BARRANCA and BAYANO in Honduras after the devastation of hurricane Fifi was submitted to Julius Soileau, Port Meteorological Officer, by the master of the BAYANO, Mr. R. Dole. This is another example of the selfless sacrifice and compassion of the men of the marine community in times of disaster or emergency.

"THOUGHTS ON THE RESCUE"

"1200 (LST) September 22, 1974, Puerto Cortes, Honduras.

"To be surrounded by so much death and destruction and not to be able to give any help other than to assist in communications, which were being so ably handled by the BARRANCA, was frustrating. It was with relief that we heard that the BAYANO's assistance was required. A report had been received by the Cortes Emergency Committee that many people in the Chamelecon area had made their way to the beaches at the river's mouth. The Committee requested that our boats make their way to the mouth of the Chamelecon River to investigate and pick up any people there (fig. 26).

"All four boats set off from both ships, manned and stored with everything from milk to additional emergency lifeboat stores. They left at 1445 and at first made good progress. Later, however, minor engine trouble on one of the boats and large quantities of weeds caused delays.

"When it was realized that, due to the delays, the boats would not be able to return to Cortes that night, the POMONA, on route from Tela to Cortes, was requested to anchor off the Chamelecon River to act as a base for the boats and take on any persons brought from the shore. The boats were advised by radio, and contact was established at 0100 September 23, between the POMONA and BAYANO 1.

"BAYANO's boats made for the river's mouth and were later joined by one boat from POMONA. The three boats returned to POMONA with a total of 72 persons rescued.

"BARRANCA's boats finally reached POMONA, at about 0700, their delay having been caused by engine trouble and fog in which they were carried well out to sea in the very strong current from the river.

"As it was now obvious that a large number of people were going to be brought off from the shore, far more than was at first anticipated, the BAYANO left Cortes taking, in addition to my own crew, as many

Figure 26.--Survivors from the Rio Chamelecon area, near Cortes, aboard lifeboats from the BAYANO.

Figure 27. -- More survivors from the Rio Tinto area, near Tela, being carried to safety aboard the rescue ships.

as could be spared from BARRANCA. When the BAYANO arrived off the Chamelecon River, most of the people in that area had been saved. Two boats, BARRANCA 1 and POMONA 1, had made their way to the mouth of the Ulua River, where it was reported that further persons waited for help.

"BAYANO took the three remaining boats in tow and anchored close to the Ulua River, and rescue work commenced, the BARRANCA 1 having just rescued a boatload from the west bank. As the BAYANO was only a short distance from the shore, it was decided to dispense with the hand-propelled boats and use the motorboats only. The people being rescued were only able to get down to the beach slowly. Thus, by the time a boat came out to the ship and returned to the beach, only one boatload had gathered.

"Rescue work continued until 1500, when all the people presently in the area were on board. Many of the rescued were suffering from diarrhea and fever. It was decided to proceed to Tela as fast as possible, rather than wait for more people to reach the beaches. At 1720 the BAYANO arrived at Tela, where the Honduran Red Cross and Emergency Committee officials were awaiting our arrival. The survivors were taken at once to a train waiting on the pier.

"The following day, September 24, the BAYANO sailed from Tela and arrived just off the Ulua River at 0915. Both motorboats were lowered to the water; one proceeded to the mouth of the river, while the other went to the village of Rio Tinto. A local informed the ship just as we anchored that the Rio Tinto was rising fast, and the whole village feared that they could be swept out to sea if the river rose high enough. Their evacuation (fig. 27) continued throughout the day, with the POMONA arriving from Cortes to take her share of survivors to port.

"Rescue work was assisted by the arrival of the Cortes pilot boat 007; it helped by taking people out to the POMONA. By 1500 most persons who wished to leave had been embarked. All boats were recalled to the BAYANO and brought on board. We arrived at Tela at 1845 with 191 survivors on board.

"The following day, BAYANO sailed at 0700 and arrived in Rio Tinto at 0830. Both motorboats were lowered and instructed to inspect the beaches from Rio Tinto to Chamelecon and pick up anyone who required assistance. Only four more persons were picked up along the whole stretch of coastline, so the BAYANO recovered both boats and proceeded to Cortes, arriving at 1440.

"Thus ended a successful operation in which about 790 persons were taken from the shore without injury to anyone or damage to ship's equipment."

GREAT LAKES CLIMATOLOGICAL SUMMARIES

Volumes 1 and 2 of a four-volume series called Summary of Synoptic Meteorological Observations for Great Lakes Areas have been published by the National Climatic Center, Asheville, N. C. The four volumes are: Volume 1 - Lake Ontario and Lake Erie; Volume 2 - Lake Huron and Georgian Bay; Volume 3 - Lake Michigan; Volume 4 - Lake Superior. The lakes are divided into 13 major areas. There are 19 tables for each area by month, and 21 tables in the annual summary.

The elements summarized are weather occurrence, wind direction and speed, cloud amount, ceiling height, visibility, precipitation, dry-bulb temperature, relative humidity, air - sea temperature difference, sea height and period, sea-surface temperature, and sea-level pressure. The data are presented in percent frequency tables with period of record. In some instances, percent, cumulative percent, number of observations, and means and extremes are given.

These surface marine observations were taken aboard cooperating Great Lakes vessels in cooperation with the Great Lakes Carriers' Association, the National Weather Service, and the Atmospheric Environment Service of Canada. Those vessels may obtain copies from the Port Meteorological Officer, Cleveland, Ohio.

MARINE WEATHER REVIEW

The SMOOTH LOG (complete with cyclone tracks [figs. 28-31], climatological data from U.S. Ocean Station and Buoys [tables 8 and 9], and gale and wave tables 10 and 11), is a definitive report on average monthly weather systems, the primary storms which affected marine areas, and late-reported ship casualties for 2 mo. The ROUGH LOG is a preliminary account of the weather for 2 more recent months, prepared as soon as the necessary meteorological analyses and other data become available. For both the SMOOTH and ROUGH LOGS, storms are discussed during the month in which they first developed. Unless stated otherwise, all winds are sustained winds and not wind gusts.

Smooth Log, North Atlantic Weather

September and October 1974

SMOOTH LOG, SEPTEMBER 1974--In general, September was a near-normal month, across the North Atlantic. As usual there were exceptions. One of the more important of these was in the northeast area -- Norwegian and North Seas and United Kingdom. Except off the U. S. east coast the extratropical storm centers stayed north of 40°N.

From the northwest to the southeast the primary climatological storm tracks are as follows: Hudson Bay to the southwest coast of Greenland, southern Canada to Labrador to Iceland into the Norwegian Sea, off the U. S. east coast to south of Iceland, and the North Sea across the Gulf of Finland.

The following are the exceptions in the actual mean tracks. The Hudson Bay-Greenland track was farther south in central Canada and curved northward sooner over Baffin Island. The track from Labrador to the Norwegian Sea was more easterly with a sharp northward curve near the southern Norwegian Coast. The U. S. east coast storms also had a more easterly component and moved over the United Kingdom turning northward over the North Sea. Only one storm ventured into the Baltic Sea area.

The pressure pattern was near normal, but more intense. The Bermuda-Azores High was the largest feature and about 5 mb above the climatic mean with two 1025-mb centers near 35°N, 42°W, and 37°N, 30°W. Another high-pressure feature was a 1017-mb High centered over northern central Greenland. The Icelandic Low, normally between Kap Farval and Iceland, was split into two centers both lower than the climatic mean. The deepest Low was north of the Shetland Islands, near 65°N, 01°W, at 999 mb. The other Low was 1005 mb over the Fury and Hecla Strait of Northern Canada. The pressure over the eastern United States and Canada was normal.

There were two positive and two negative anomalies that were significant. A positive 6-mb was centered over the north central Greenland Ice Cap. A large positive 5-mb center was near 35°N, 30°W, with the 4-mb isoline roughly covering the area from 30° to 40°N and 10° to 50°W.

The two negative anomalies were located near the Low centers. The largest, a negative 10-mb, was centered near 61°N, 01°W, with negative values covering all the area northeast of a line from Kap Farvel to the Bay of Biscay to central Italy to the White Sea. The other negative center was minus 4 mb centered with the Low over northern Canada.

The upper-air pattern also had a more intense gradient. The center of the High over the Middle Atlantic was 195 ft higher than the mean for the 700-mb sur-

face. The two upper-air Lows were reversed from the surface Lows in intensity. According to climatology the primary mean Low is centered over the North Pole. This month it was over 1,200 mi away, near 69°N, 88°W (not far from the magnetic North Pole), and associated with the surface Low near that point. This produced a negative anomaly of over 340 ft for the height of the 700-mb surface near that position. The upper-air Low associated with the surface Low over the Norwegian Sea resulted in a 300-ft anomaly.

The North Atlantic hosted four tropical cyclones this month, two tropical storms - Dolly and Elaine - and two hurricanes - Fifi and Gertrude. Although it formed the last of August, hurricane Carmen spent most of her life-span during September. Tropical cyclones of 1974 are described in the annual article, "North Atlantic Tropical Cyclones, 1974," on page 8 of the January 1975 issue of the Mariners Weather Log.

Extratropical Cyclones -- A front extended east-west across the Atlantic to Nova Scotia, where it curved southwestward along the coast, on the 4th. A large HIGH was centered over the midwest, and tropical storm Dolly was moving northeastward off the U. S. east coast. Late in the day, a wave formed off the southwest corner of Newfoundland.

The LOW raced across the Atlantic, traveling 1,000 mi in 24 hr. At 0000 on the 7th, it was at 53°N, 12°W with a pressure of 969 mb. The ship GUJL was off Lands End and being battered by 50-kt winds from the southwest. The SASHA BORODULIN was, near 49°N, 10°W, not far away and taking a 40-kt beating. During this melee a merchant ship sank in the English Channel, and the crew was rescued by helicopter. The MOSGULF measured a fantastic 75-kt hurricane-force wind from 230° at 50.8°N, 11.1°W, about 100 mi south of the center. The sea waves were 20 ft. The AMERICAN LEGACY at 49.1°N, 08.3°W had 45-kt gales, 6 hr later, with 26-ft swells and 10-ft seas.

The storm maintained its strength as it passed over central England, but the winds were not as strong. The DART AMERICA was on the receiving end of 35-kt gales at 48.5°N, 11.5°W, at 1200, with no other reports between her and land.

The LOW had slowed as it turned northeastward and was weakening as it moved up to the coast of Norway on the 8th. A station on the Netherlands coast reported 40-kt gales at 1200. The storm continued tracking northward until it was over Spitsbergen.

At midday on the 7th, a wave formed on a front east of Long Island. It moved northeastward, as is the usual case, and, by 1200 on the 8th, was a 993-mb storm over the Grand Banks. The DAWSON was tossed by 50-kt winds west of Cape Breton Island. The WIELDRECHT just to the north off Sydney had 45-kt northeasterly gales. At 1800 the AMERICAN ACE had 43-kt gales.

The storm turned to an easterly track and, at 0000 on the 9th, the ATLANTICA LIVORNO was hit by 40-kt gales at 41.5°N, 46°W. In the next 12 hr the central pressure dropped 13 mb to 972 mb. The EXPORT LEADER, near 40°N, 41°W, was caught by 45-kt gales with 16-ft seas and 20-ft swells. About 400 mi south of the center (44°N, 37°W) the USNS COMET was headed into 40-kt gales. Gale-force winds were reported in all quadrants. On the 10th, four ships reported 45-kt gales. They were the HORNWIND, KARA, PAULA, and PUEBLA. Three of these reports were in the southwest quadrant. Gale reports were in all quadrants except to the north where none were plotted. The KARA reported swells of 33 ft. Other ships reporting gale-force winds on the 9th and 10th were the AMERICAN TRADER (twice) with 25-ft swells and the ZIM NEW YORK with 26-ft swells.

On the 11th and 12th, the LOW was headed towards Ireland and filling rapidly. The LOW split into two centers and, on the 13th, the circulation combined with another LOW over Iceland.

A 1009-mb wave was analyzed over Michigan on the 0000 chart of the 13th. Twenty-four hours later, it was over New Brunswick at 999 mb. The VGBZ off Cape Sable recorded 40-kt gales. As the storm moved over the water it steadily gained strength. At 1200 on the 16th, the 975-mb center was 150 mi south of Keflavik. The BAMSA DAN, near 61°N, 20°W, was tossed by 50-kt winds and 33-ft seas. The OXKJ, at 59.1°N, 22.7°W, struggled with 45-kt winds and 30-ft seas. Ocean Station Vessel "I," slightly farther south, was in better shape with only 40-kt gales, 15-ft seas, and 13-ft swells. On the 17th, the LOW moved into the Norwegian Sea and joined another LOW farther north.

Cape Hatteras produced this storm. It started innocently, on the 17th, as a very minor frontal wave. Its path was along the Gulf Stream as it raced northeastward. At 0000 on the 19th, it was already over St. Mary's Bay. A ship had 40-kt southwesterly winds near the warm front at 46°N, 49°W.

The storm continued its northeasterly course and had a central pressure of 972 mb about 100 mi south of Keflavik on the 20th. The MARIE L. BOLTEN was near 58°N, 30°W, about 350 mi southwest of the center, headed into 50-kt westerly winds, 26-ft seas, and 31-ft swells. Ocean Station Vessel "I" had been receiving 40-kt winds for over 6 hr. At 0000 on the 21st, her winds increased to 45 kt, and the seas were 23 ft.

At this time the center was just south of the coast of Iceland and taking on a southerly component in the track. The ORDUNA reported 50-kt west-northwesterly winds, at 1200 on the 21st, with 30-ft swells, near 53.5°N, 18.6°W. Farther to the southwest the C. P. DISCOVERER, near 52°N, 25°W, was headed into 45-kt gales and 26-ft seas and swells. There were many gale reports in the southern half of the storm's circulation. By 0000 on the 22d the winds had decreased to 35 kt from the northwest at OSV "I" but the seas were 26 ft and the swells 23 ft from the west-southwest. The storm center was recurving to a northerly direction. Even so, its effect was felt as far south as Cabo Finisterre where the GMPJ had 40-kt gales.

As the LOW moved into the Norwegian Sea it lost its punch, but managed to survive as a system, until the 29th, over Spitsbergen.

This storm formed in midocean, hard on the heels of the previous one, on the 22d, near 55°N, 30°W. Within hours it was generating gale-force winds. It treat-

ed Ocean Station Vessel "J" to 45-kt winds, 20-ft seas, and 25-ft swells as it passed to the north, on the 22d. On the 23d, the AMERICAN ACE, AMERICAN ARGOSY, DOCTOR LYKES, and SYLVO all reported 45- to 50-kt winds in the southern half of the storm. The storm reached its lowest pressure of 978 mb over the Irish Sea that day. On the 25th, the LOW moved into Scandinavia and started the decaying process.

Frontal waves had rippled along a front stretching from Long Island to Louisiana. On the 22d, one of them developed as it neared and moved up the New England coast. At 1200, the drilling vessel VGBZ experienced 40-kt winds. The center of the LOW passed over the Strait of Belle Isle, on the 23d. During this time there were isolated gales reported with the storm as it raced across the Atlantic. It was not until the storm was centered over the North Sea, at 982 mb, that the highest winds were reported south of Ireland. The DAPHNE, at 49.8°N, 07.5°W, had 41 kt and 25-ft waves. The AMERICAN LEGEND, very close by at 48.9°N, 07.8°W, calculated 50-kt winds and 18-ft seas.

To dispel the idea that relatively strong winds can only occur with cyclonic circulations, the CARBIDE TEXAS CITY, at 34°N, 75.8°W back on the 24th, had 45-kt gales and 15-ft waves on the southeast side of a large HIGH in anticyclonic circulation. True, the strongest and most violent winds are with cyclones.

This LOW was first analyzed about 500 mi east of Cape Hatteras on the 26th. It quickly expanded its circulation. At 1800, the EXPORT FREEDOM, at 42.5°N, 54.5°W, battled 45-kt gales and 20-ft seas. The higher winds at this time were in the northeast quadrant north of the warm front, except that the MOSGULF encountered a measured 52-kt wind at 41°N, 51.7°W, in the southeast quadrant west of the fronts.

As the LOW moved over the Grand Banks, it was a tight, small storm. At 1200 on the 27th, gale winds were reported in all except the west quadrant. The DART AMERICA near 44°N, 36°W, the HAVDRILL near 49°N, 52°W, and the WESER EXPRESS near 48°N, 49°W, all reported 45-kt winds. The WESER EXPRESS measured 23-ft swells.

On the 28th, the LOW was moving very slowly northward toward Kap Farvel, and filling. Another LOW was approaching from the south and became the dominant circulation on the 30th.

Casualties--The only other weather casualty noted this month was the 1,057-ton ORMLUND. While anchored outside Belize for repairs, high winds caused the vessel to drag anchor and run aground on the lighthouse reef. The 8,453-ton Greek ALIKI had engine failure in the Tyne River during a gale and drifted aground on rocks, on the 2d. During hurricane Carmen, on the 7th, the jack-up drilling barge PENROD 60 (5,819 tons) was ripped off location. The barge was recovered, but was found to have lost legs, derrick, and drawworks.

SMOOTH LOG, OCTOBER 1974--The total number of storms that affected the area of the Northern Hemisphere between 100°W and 30°E was well above normal, but only normal for the oceanic area. The storm tracks over water had the appearance of being rotated about 30° counterclockwise with the center of rotation near Newfoundland. The primary storm track out of the midwest, across the Great Lakes, and into the Labrador Sea was near the climatological normal, until it turned more northerly toward Davis Strait. The track off the east coast of the United States was farther east with a more northerly component that took it into the Denmark Strait rather than south of Iceland and into the Norwegian Sea. There were two cyclones that wandered in the Azores area for days. The cyclones over the continent of Europe also tended to move in circular paths. There were several weak cyclones over the central Mediterranean Sea. Hurricane Gertrude extended into this month, but formed in September.

The 30-day mean pressure centers departed more from normal than the cyclone tracks. Normally the Icelandic Low is centered near 63°N, 30°W, at 1002.4 mb. This month there were two centers, a 1006-mb near 62°N, 60°W, and a 1005-mb near 57°N, 20°E. The high pressure centers differed from the climatological mean even more significantly. The long-range climatic mean shows a 1020.2-mb High south of the Azores, near 34°N, 35°W, with two 1018.6-mb subcenters, one centered over eastern Kentucky and the other near Bayonne, France. There were two major high-pressure centers this month, a 1028-mb near 47°N, 19°W, and a 1025-mb in the normal position over eastern Kentucky, both higher than normal.

The major anomaly that affected North Atlantic waters was a positive 16-mb associated with the 1028-mb High, and centered near 53°N, 20°W. Another positive 6-mb center was colocated with the 1025-mb High. The North Atlantic from approximately 15°N northward averaged higher pressure than normal except for the North Sea and a narrow north-south trough along 60°W which averaged zero departure.

The only significant, in fact only, negative anomaly center was a minus 12-mb, centered near the Gulf of Danzig.

The upper-air pattern was becoming more intense with the main Low near the North Pole deepening. The major trough that normally exists over the eastern United States was farther to the east, off the coast, and sharper than usual. This and a ridge over the eastern ocean resulted in northeasterly rather than easterly zonal flow. An upper-air Low was stacked nearly vertically with the surface Low over the Gulf of Danzig. The trough from this Low extended southward across the central Mediterranean Sea.

Extratropical Cyclones -- This was a combination of two LOWs and is interesting as much for location and behavior as for high winds and waves. On the 1st, a relatively weak LOW (1004 mb) was located near 47°N, 34°W. A HIGH was centered to the northeast near 57°N, 20°W. The CHERTAL found 40-kt east-southeasterly winds and 21-ft swells about midway between the two centers. As this LOW moved north-northeastward, on the 2d, another LOW formed near 47.5°N, 42.5°W, and moved southeastward. By 1200 on the 3d, the second LOW was the only remaining cyclonic circulation.

The LOW continued moving southeastward, and, on the 4th and 5th, the center made two cyclonic loops,

moving westward and then northwestward in the process, as a high-pressure center to the north moved eastward. At 1200 on the 4th, the ORE CHIEF was in latitude 36°N, longitude 32.9°W, with 50-kt winds, 16-ft seas, and 21-ft swells. Some distance north of the center, at 43.4°N, 24.2°W, the ALMERIA LYKES contended with 45-kt gales. At 1200 on the 5th, the pressure gradient tightened between the two centers, and the ORE CHIEF, at 38.5°N, 29.5°W, was pounding into 60-kt winds, moderate rain, 24-ft seas from 070°, and 26-ft swells from 340°. Both the FORT LA REINE and POINTE ALLEGRE had it easier, but were buffeted by 40-kt easterly winds, and seas and swells to 20 ft.

The LOW wandered in the area west of the Azores Islands, in association with its cutoff LOW upper-air support, until the 10th. During this time it drifted northward and slowly filled. By the 11th, the upper-air LOW had dissipated and the remaining cyclonic circulation moved toward the African coast.

This was one of those few situations where relatively high winds were associated with anticyclonic curvature around a HIGH. A large HIGH, averaging about 1035 mb, moved southeastward out of Canada and dominated the United States east of the Rocky Mountains the first week of the month. A cold front had preceded it and stalled along a line approximating Bermuda to Belize. The pressure gradient off the Southeast and Gulf Coasts increased as the HIGH moved southeastward.

The first ship to report gale-force winds of 46 kt was the PLAN DE SAN LUIS, at 19.5°N, 95.7°W, at 0600 on the 3d. The SOCONY VACUUM followed suit with 45-kt winds, at 1200 on the 4th, at 26.2°N, 86.2°W; 12 hr earlier the winds were 35 kt. The higher winds shifted eastward, following the SOCONY VACUUM, and, at 0000 on the 5th, they were 40 kt as she passed through the Straits of Florida. There were reports of 35-kt winds over the Gulf of Mexico through 0000 on the 6th.

At 1200 on the 5th, the MARJORIE LYKES was off the east coast of Florida, at 27.8°N, 97.7°W, with 45-kt winds and 20-ft seas. A LOW developed on the front over eastern Cuba, on the 5th, and moved northward off the east coast of Florida by the 7th. On the 6th, 7th, and 8th, the GULFCREST, MARJORIE LYKES, MOBIL LUBE, SOCONY VACUUM, and the USCGC COURAGEOUS, all fought 42- to 48-kt winds from the northeast. The seas were running up to 20 ft, and the swells to 26 ft. The LOW dissipated on the 8th.

The first 2 wk of the month were more like summer than winter. Many stable waves formed and dissipated, but very few developed even gale-force winds. Although this LOW developed on the 10th, it was not until the 12th that it concerned shipping. It moved southeastward out of northern Quebec, and the center crossed Newfoundland late on the 11th. At 1200 on the 12th, the 1000-mb center was near 49°N, 47°W, and the ZIM TOKYO was at 42.8°N, 53.6°W, with 45-kt northwesterly gales on her starboard side. The seas were 20 ft. Twelve hours later she still suffered 40-kt gales with 16-ft seas.

The path of the LOW had now turned northeastward and the pressure had decreased rapidly. At 0000 on the 14th, the pressure was 972 mb near 60.5°N, 33°W. At that time the MONT LOUIS was near 56°N, 31°W, or about 300 mi south of the center, sailing into 50-kt blustering winds and 23-ft seas. Off the coast of Labrador the PELICAN was braving 40-kt winds and 26-ft seas. Later that day there were several reports of gale-force winds including 45 kt by the C. P. DISCOVERER with 33-ft seas. On the 15th and 16th, the LOW was moving into the Denmark Strait and filling. Late on the 16th, it had disappeared.

The storm formed near the Kansas City stockyards, on the 13th, behind a HIGH that had moved eastward across the Great Lakes. As the storm moved across the Lakes, on the 14th, gale warnings were posted. By 1200 on the 15th, the LOW was near 54°N, 69°W, at 990 mb. The VGBZ was at the northern tip of Nova Scotia with 40-kt winds. Twenty-four hours later, the 980-mb center was over the Labrador Sea at 59°N, 54°W. The PELICAN was still at the same position off the Labrador coast and fighting 60-kt winds and 31-ft seas.

Late on the 16th, the surface LOW crashed against the southwest coast of Greenland and broke around the southern tip. At 0000 on the 17th, there were two 980-mb centers, one on each side of the island. Within a matter of hours the west coast LOW disappeared as the upper-air LOW moved eastward. The PELICAN and MONT LOUIS were both reporting 50-kt storm winds. The PELICAN was ravaged by 43-ft seas. At 1200, the NANOK S., near 60°N, 38°W, battled 50-kt winds. The QUEEN ELIZABETH 2 was easily sailing eastward near 51°N, 24°W with 40-kt westerlies.

The surviving LOW continued an easterly track and moved across Iceland on the 18th. The OYOR, at 60°N, 36°W, was contending with 45-kt gales on the 19th, and, as the LOW entered the Norwegian Sea, it stalled and disappeared in a larger circulation centered over the Skagerrak.

A polar front paralleling the U.S. east coast had moved off the coast, on the 16th, and stalled about 300 mi off the coast. An arctic front crossed the coast on the 18th, and by the 20th the two combined and one reinforced the other. On the 19th, a frontal wave formed off northern Florida and moved northeastward. It gained strength rapidly with the combined energies. At 0000 on the 20th, it was 998 mb, near 36°N, 68°W, and generating gale-force winds on the cold side. The CANAL GRANDE near 39°N, 64°W, and the CETRA COLUMBA near 33°N, 71°W, both were hit by 40-kt gales.

The storm raced northeastward and by 1200 was off Cape Sable at 982 mb. The ALERT, between Cape Sable and the LOW's center, was buffeted by 45-kt gales. At 1800, the MOSGULF and WARRIOR were on 41.2°N, and 59°W and 60.5°W, respectively. The MOSGULF measured 45-kt gales, and the WARRIOR estimated 55 kt with 15-ft seas and 25-ft swells. At 0000 on the 21st, the small intense LOW was centered east of Anticosti Island at 967 mb pressure. For such a deep extratropical LOW it was very small--more like a hurricane. SEDCO I and VGFQ both had howling 40-kt winds. As the storm continued its race northward and entered the Labrador Sea without the friction of land surfaces, the winds increased. The

HUDSON, about 160 mi southwest of Kap Farvel, encountered roaring 65-kt east-northeasterly winds. The sea and swell reports appeared to be 43 ft and 49 ft, respectively, but were not clear due to analysis features. The C. P. VOYAGER, near 52°N, 51°W, had 50-kt southwesterly winds and 21-ft seas.

As the LOW moved onto the rugged west coast of Greenland, it rapidly deteriorated, but managed to remain alive until the 23d over Disko Island.

Monster of the Month--This storm formed, on the 22d, west of the same front that was associated with the storm above, in the wake of a wave that moved northward along the front. In terms of synoptic meteorology, the front had moved very slowly eastward as a large HIGH, centered near the Azores, blocked its progress. Almost immediately gale-force winds were measured both to the north and southwest of the center. By 0000 on the 23d, the 1000-mb LOW was at 35°N, 57°W. Two ships were pounded by 45-kt winds northwest of the center. They were the ATLANTIC CARRIER reporting 16-ft seas and the SUGAR CARRIER reporting 16-ft seas and 26-ft swells. With the price of sugar it is hoped her cargo was safe as she was headed northward toward the market.

For a rather shallow storm, this one generated high winds. At 1200 on the 23d, the 996-mb maelstrom was at 36°N, 58°W. The LESLIE LYKES was about 150 mi north of the center at 38.5°N, 57.5°W, and mauled by 65-kt northerly winds, 31-ft seas, and 62-ft swells. Nearby at 38°N, 59°W, the BELVAL was battling a 55-kt storm, but no seas were included. The SUGAR CARRIER, at 35°N, 60°W, had not made much headway as she fought 50-kt northwest winds on her bow. She was reporting 20-ft seas. The storm continued moving northward with gale-force winds in all quadrants. The LOS ANGELES, at 41.9°N, 56.2°W, at 1800 on the 24th, was lashed by 45-kt gales.

Late on the 24th, a new low-pressure center developed about 240 mi to the north, and another center was analyzed east of Frobisher Bay. On the 25th, all these centers appeared to literally leap toward Kap Farvel and split into two centers on the rocky point. While this was occurring, the LAURENTIAN FOREST contended with 40-kt gales. One low center moved northward up the west coast and the primary low center northeastward up the east coast of Greenland. The FJALLFOSS, near 61°N, 34°W, rocked with 45-kt gales. On the 26th, the storm curved eastward and over Iceland, as the FJALLFOSS sailed eastward with 50-kt westerly winds. No waves were reported. The central pressure was now 972 mb. To the south, Ocean Station Vessel "I" recorded 45-kt winds with 21-ft seas and 18-ft swells. At 0000 on the 27th, both ships had 45-kt winds, but INDIA now had 36-ft seas with a 12-sec period, and 39-ft swells with a 13-sec period. At 1200, the KOMMUNIST, near 60.5°N, 15.5°W, was battered by 50-kt winds and 33-ft seas of 10-sec period. Forty-knot winds were blowing onto the Netherlands coast. The LOW had now moved across the Shetland Islands to the Baltic Sea. The QUEEN ELIZABETH 2 (65,863 tons) was forced across the basin by gales, while leaving her berth at Cherbourg, France, at 2300 on the 27th. She struck the opposite pier and sustained a 10-m-long tear, 5 m above the water. Two longshoremen were injured. The winds were reported to have been 55 kt. At 1200 on the 28th, a Norwegian coastal station west of Oslo came over the circuits as 60 kt. This could have been from the funneling effect of a fjord, or a misprint. Many northern coastal stations were reporting gale-force winds. The LOW moved southeastward into Poland, filling rapidly.

Casualties--The 11,633-ton Greek tanker EUROPEAN RIVER, 3 mi off Piraeus, was having difficulty making engine repairs due to bad weather. The Greek freighter PANAGIOTIS XILAS (8,764 tons) was in a collision with an East German coastal vessel, in dense fog, near Hamburg Harbor. The 9,268-ton British freighter RUPERT DE LARRINAGA, from Antwerp to Wilmington, N. C., arrived on the 7th with heavy weather damage to hull and cargo. The barge OCEAN 96, in tow of a tug, veered off course in high winds and contacted jetty rocks in St. John's River, near Jacksonville, Fla., on the 21st. The 8,210-ton Greek motor vessel ore carrier TEES ORE ran aground in Orinoco Bay, due to alleged strong winds and current, with a full cargo of iron ore. The Lebanese-registered EURABIA SUN (3,840 tons) developed a large list during a gale over the North Sea and sank near 53.6°N, 05.9°E. The crew was rescued.

Smooth Log, North Pacific Weather

September and October 1974

SMOOTH LOG, SEPTEMBER 1974--Climatology indicates that the most prominent primary storm track this month stretches from Honshu to southwestern Alaska, crossing the Aleutians near Adak. Another less traveled path comes out of the eastern U.S.S.R., across Sakhalin Island, and joins the previous track in the southern Bering Sea. A third track forms about 50°N, 160°W and proceeds northeastward into the Gulf of Alaska.

The storm tracks this month were much more dif-

fuse than usual. The track out of the U.S.S.R. was normal, except it stopped in the Sea of Okhotsk. The track from Japan split into two branches, one into the western Bering Sea, and the other south of the Aleutians into the western Gulf of Alaska. The track from midocean was more northerly. The number of cyclones was near normal.

The mean pressure pattern was more chopped up than normal. The Pacific High normally has a 1021-mb main center near 36°N, 145°W, and a 1017.7-mb subcenter near 35°N, 165°E. This month there were five centers: the highest was 1019 mb off Vancouver Island, with four 1018-mb centers stretched along approximately 35°N between 135°W and 170°E. The 1016-mb isobar looked like a large U lying on its left side, with the right side covering western Canada and northeastern Alaska. This resulted in higher than normal pressure over that entire area.

The 1007-mb climatological Aleutian Low is centered over Cape Romanzof, Alaska. This month the low-pressure area consisted of four subcenters. A 1009-mb center was located in the open center of the high-pressure U, near 55°N, 158°W. A 1012-mb center was slightly east of the Kamchatka Peninsula. A 1009-mb Low was near 48°N, 130°E, in northern Manchuria with a 1010-mb subcenter over the northern tip of Sakhalin Island.

The largest anomaly in the area was a positive 9-mb center over the Beaufort Sea. A positive ridge extended south-southwestward from this center across the central Bering Sea, another ridge extended south-southeastward along the Rocky Mountains. A small positive center was located over the Kuril Islands. The only significant negative anomaly was 6 mb centered near 40°N, 150°W.

There were seven tropical cyclones in the North Pacific, five in the west and two in the east. They were typhoons Shirley, Virginia, and Agnes; tropical storms Trix and Wendy, and hurricanes Norma and Orlene. See page 75 of this issue for a summary of the "Eastern North Pacific Tropical Cyclones, 1974."

Extratropical Cyclones -- Except for typhoon Shirley, the first 2 wk of September were relatively quiet. One storm extended into the month from August, and the first storm started early in the second week, but did not develop into a significant storm until late in the week.

The LOW had its inception between Honshu and Hokkaido on the 8th. It tracked northeastward off the Kuril Islands as a minor wave until it entered the circulation of another LOW over the northern Sea of Okhotsk on the 10th. The combined circulation then turned southeastward as extratropical Shirley approached from the southwest. The track was following a path north of the Aleutian Island chain and slowly deepening. The VAN TRIUMPH was at 50.8°N, 169.2°W, at 1800 on the 12th, and found the first 42-kt gales.

On the 13th, the LOW crossed south of the islands and the winds increased. At 1200, the LOW was 979 mb near 54°N, 167°W (Unalaska Island). The SUMMIT was near 53°N, 171°W with 45-kt northerly winds and heavy rain. The seas were 15 ft and the swells were 20 ft. At 0000 on the 14th, the 7KTK, about 52°N, 168°W, also experienced 45-kt gales with 15-ft seas and 26-ft swells. The VAN FORT measured 45-kt winds, at 0600, near 51.6°N, 169.3°W, with 36-ft seas and 16-ft swells.

As the storm moved into the Gulf of Alaska it had its lowest pressure of 977 mb on the 15th. At 0000 the center was near 52.5°N, 160°W, and the WAKAURA MARU was near 46°N, 165°W with 40-kt winds. The direction of movement was turning northward at a slow pace as the surface LOW was almost vertically aligned with the upper-air LOW. Minimum gale-force winds were periodically reported as the storm weakened. Late on the 17th, the center crossed the Alaska Peninsula in a westerly direction, and on the 18th disappeared into another system over the Bering Sea.

This LOW at first glance seemed to appear on the weather chart out of nowhere, over the Bering Sea. A closer examination shows it was probably a consolidation of the circulation of several weak LOWs, located around the edge of the Bering Sea, including the one just described above. The 1200 chart of the 17th showed a ridge extending northward into the Bering Sea with three diffuse LOWs extending down the Siberian Coast, and a dissipating LOW over the Alaska Peninsula.

By 0000 on the 18th, the ridge had retreated southeastward and a 997-mb LOW was centered near 57°N, 179°E. About 450 mi to the south, the OREGON MAIL was lashed by 50-kt winds just behind the cold front. The LOW moved southeastward and crossed the Aleutian Islands about 0000 on the 19th. At 0000 on the 20th, the PACSTAR was about 300 mi west of the 994-mb center with 40-kt winds on her port side. Later in the day, the major circulation combined with another LOW, and a third LOW developed, giving a long north-south shape to the system.

On the 21st, the northern LOW split off to the north and the new LOW to the south became the dominant system. It traced a fishhook-shaped path as it moved counterclockwise, circling back north-northwestward before disappearing on the 23d.

An unstable wave formed on a front just south of Osaka, Japan on the 24th. It increased in amplitude as it moved northeastward and, by 0000 on the 25th, was a 1004-mb LOW near 39°N, 147°E. The DAIGOH MARU was northeast of the center and reported 40-kt southeasterly winds. Twelve hours later, she was buffeted by 45-kt southerly gales and heavy rain as she moved eastward and the storm moved northeastward. The FREESIA was near 43°N, 153°E and rocked by 50-kt portside winds. Her pressure had fallen 5.5 mb in the past 3 hr.

At 0000 on the 26th, the storm was small, with a 997-mb center near 45°N, 155°E. The LEO was about 120 mi due east of the center and measured 45-kt southeasterlies. The KINYO MARU and MONTIRON both reported 40-kt gales along 44°N, at 159° and 157°E, respectively. The LOW continued tracking northeastward outside the Kuril Islands and increased its area of circulation, but the pressure remained constant.

On the 27th, it turned southeastward and started to fill as a high-pressure area built over the Bering Sea. By the 30th, the LOW was defeated by the HIGH.

A cutoff LOW had wandered around in the mid-Pacific

since the 24th. On the 29th, it started moving northeastward as the upper-air LOW combined with a major trough. This loss of upper-air support spelled its doom though, as another surface LOW developed farther to the northeast. This new LOW moved and deepened rapidly. By 0000 October 1, it was a 982-mb storm located near 55.5°N, 144°W. The AH JIN, at 53.5°N, 152°W, and the THAMES MARU, at 52.5°N, 146°W, both reported 35-kt gales. At 1200, the CHEVRON CALIFORNIA, near 57°N, 145°W, had 40-kt gales from the north on her portside. At 1800, the SUMMIT, at 56.6°N, 155.4°W, had bone-chilling 52-kt winds out of the northwest.

By that afternoon, at 0000 on the 2d, the CHEVRON CALIFORNIA was churning through 50-kt winds and 18-ft swells. The HILLYER BROWN, off Montague Island, and the NEWARK, at 56.7°N, 144.4°W, both contended with 45-kt gales. The ESSO NEWARK, near 54.5°N, 142°W, had only 35-kt gales, but the seas were running 20 ft. The CALIFORNIA appeared to be standing offshore as she remained in the same general area with the winds still blowing at 45 kt, and rode 15-ft seas and 18-ft swells. Late on the 2d and early on the 3d, the storm blew out against the mountainous shore with only a trough remaining.

Monster of the Month--The monster of the month would have to be one of the several vicious tropical cyclones that occurred in both the Atlantic and Pacific.

Tropical Cyclones, Western Pacific--On Sunday night (8th) typhoon Shirley, packing 70-kt sustained winds along with 85-kt gusts, moved over Kyushu, Japan. She dumped 5 to 17 in of rain on both Kyushu and Shikoku. These torrential downpours triggered flooding and landslides that resulted in 13 deaths and thousands of damaged homes. Transportation, power, and communication facilities were all disrupted. Shirley was first detected as a tropical depression, on the 4th, about 200 mi southeast of Okinawa. She intensified quickly. Before the 4th was out Shirley was a tropical storm. She was on a northwestward path. By the 6th she was a typhoon, moving through the Ryukyus. Shirley turned northeastward toward the Japanese mainland on the 7th.

As Shirley was developing into a typhoon, tropical storm Trix flared up briefly off the China coast. She developed about 100 mi south of Hong Kong on the 5th. Moving northwestward Trix became a tropical storm the following day as winds near her center reached 40 kt with gusts to 50 kt. However, she was too close to the coast to develop further and a few hours later rammed ashore near Tien-pai, China.

On the 12th a tropical depression was discovered near 31°N, 151°E. It drifted northeastward and 12 hr later, at 0000 on the 13th, was typhoon Virginia. The typhoon was already fairly far north, but she continued to intensify. On the 14th, near 37°N, 156°E, Virginia's maximum winds were estimated at about 80 kt, with gusts to 100 kt. Gales extended out 150 to 200 mi. The PRESIDENT VAN BUREN, about 200 mi north of the center, encountered 45-kt winds and 23-ft swells. After this Virginia began to weaken and turn extratropical. She still packed some punch, however, as attested to by the AKAISHI MARU, which battled 55-kt winds close to Virginia's center at 0000 on the 15th. By the 16th, with her center near 41°N, 155°E, winds were down to 40 kt and the storm was extratropical.

There was a one-week lull before Wendy and Agnes came to life. Tropical storm Wendy was spotted, on the 24th, in the South China Sea midway between Hainan and northern Luzon. As a depression she moved across northern Luzon that same day. Wendy reached tropical storm strength as she came off the Island. She then turned northward, on the 25th, and moved slowly through the Luzon Strait during the next few days. During this period Wendy fluctuated between tropical storm and tropical depression intensity but, on the 27th, winds near her center increased to 60 kt with gusts to 75 kt. At this time she was moving northward just off the east coast of Taiwan.

While Wendy was hesitating in the Luzon Strait, Agnes was springing to life near Marcus Island. She developed into a tropical storm on the 25th, south of Marcus Island, and reached typhoon strength, on the 27th, about 200 mi northwest of Marcus Island. The following day, Agnes began to recurve east-northeastward, but she continued to intensify. On the 30th, after crossing the 30th parallel near 155°E, winds near her center climbed to 105 kt gusting to 130 kt. Winds of 100 kt extended out 50 mi while gales extended nearly 200 mi in all directions. The OCEANIC PEACE encountered 40- to 50-kt winds some 200 mi southwest of the storm center. After reaching this peak Agnes' intensity began to drop as she started an extratropical transformation. By the 2d, near 44°N, 173°E, Agnes had dropped to tropical storm strength and soon after she became extratropical. However, the TOSEI MARU ran into 45-kt winds in 20-ft seas some 250 mi southeast of Agnes' center.

While Agnes was heading into the midlatitudes, Wendy was moving across northern Taiwan and stalling in the Formosa Strait. She crossed the rugged Island, on the 28th, as a tropical storm. Once into the Strait she slowly faded and, by the 30th, was a weak stationary depression. Wendy was, however, responsible for the sinking of the 3,570-ton Panamanian-registered freighter SUNG SHAN near 21.5°N, 120.7°E, or about 400 mi east of Hong Kong, on the 28th. Three men were rescued from heavy seas by the Japanese tanker KAIEN MARU, but the remainder of the 34-man crew perished.

Casualties--There were no weather-connected casualties that came to our attention this month, other than those connected with typhoons Shirley and Wendy.

SMOOTH LOG, OCTOBER 1974--The number of cyclones traversing the North Pacific this month was above normal. The paths they followed were close to the climatological mean in the gross pattern. There were fewer cyclones traveling and forming south of Japan, and these moved easterly rather than northeasterly. There was a favored track from across Hokkaido to south of the Aleutian Islands to the Gulf of Alaska. Few storms entered the Bering Sea and none crossed it from any direction. There were more

storms than normal that formed south of the Aleutians between 40° and 45°N, and they formed farther west.

The mean pressure pattern closely matched the climatic mean, except for the central pressures. The Aleutian Low was 998 mb near 57°N, 155°W, or about 240 mi east of the 1002.5-mb climatological position near 58°N, 163°W. The 1024-mb Pacific High was near 36°N, 138°W, only a few miles from the 1019.8-mb climatological location near 34°N, 139°W. The 1020-mb isoline had a bell shape with the handle extending over Vancouver Island. This resulted in a ridge over the Pacific northwest coast.

The anomalies were not exceptionally large, but there were several important centers. A negative 6-mb center was just southeast of Kodiak Island. Another negative 5 mb was centered near 46°N, 180°, reflecting the more southerly track of some storms. The positive anomalies were inland from Cape Navarin (8 mb) and two 6-mb centers were off the U. S. west coast, one near Vancouver Island and the other about 300 mi west of Cape Blanco. There was also a positive 12-mb center north of Point Barrow.

The major differences in the upper-air flow were a displacement southeastward of the Low to over Bristol Bay, and a ridge over Kamchatka and eastern Siberia to an abnormal High centered over the East Siberian Sea.

There were six tropical cyclones, two in the eastern and four in the western ocean. They were hurricane Patricia, tropical storm Rosalie, and typhoons Bess, Carmen, Della, and Elaine. See page 75 of this issue for the annual summary of "Eastern North Pacific Tropical Cyclones, 1974."

Extratropical Cyclones--The North Pacific was relatively quiet during the first third of the month. It was also basically during the first half of the month that the storms occurred that developed off Japan and produced the southern storm track. This LOW formed southeast of Tokyo on the 6th. It raced eastward under the zonal flow until the 8th when it started deepening in midocean. At 1200, the LOW was at 42.5°N, 177.5°W, with a central pressure of 966 mb. The WAKANESAN MARU, about 150 mi southwest of the center, reported 40-kt gales. This was the storm that forced the crew of the TAI KI to abandon their replica of an ancient Chinese junk in which they had hoped to sail to South America.

The LOW continued moving northeastward, but at a slower pace. There were several reports of gale-force winds. As the 976-mb LOW moved into the Gulf of Alaska (51.5°N, 147°W), the KING WILLIAM, near 50°N, 149°W, about 100 mi southwest of the center, was battered by 55-kt storm winds at 0000 on the 11th. The seas were coded as 10 ft with swells of 49 ft. About the same distance to the southeast, Ocean Station Vessel "P" measured 40-kt winds and 13-ft seas. The PORTLAND (57.2°N, 150.1°W, 1800) fought 45-kt winds, 12-ft seas, and 20-ft swells, while the MAMMOTH PINE (52.5°N, 142.5°W, 1200) and the USCGC PLANETREE (58.7°N, 140.8°W, 1800) measured 50-kt winds, heavy rain, 20-ft seas, and the PLANETREE, 30-ft swells. The storm turned more northward, maintaining nearly the same pressure until 0000 on the 12th. Twelve hours later, there had been almost explosive filling (998 mb) as the center moved onto the coast. By the 13th, only a trough remained.

Unstable waves were rippling along a front, over the East China Sea and south of Japan, as it was being pulled into typhoon Bess. On the 12th, a stable wave survived east of Tokyo and raced across the ocean under the influence of the upper-air zonal flow. By 0000 on the 14th, 36 hr later, it was a 988-mb storm near 41°N, 166°W. The TAIZAN MARU was near the apex of the occlusion with 45-kt winds and 23-ft swells. Within another 24 hr it was 962 mb and in the Gulf of Alaska. At 1800, the SANTA CLARA and STELLA PRIMA were both about 350 mi southeast of the center with 50-kt winds. In the same area, other ships were reporting lighter winds, but higher waves, up to 26 ft.

On the 15th, there were several 50-kt wind reports, but the highest was 60 kt by the EMMA JOHANNA, at 1800, near 54°N, 139.6°W, out of the southwest. At this time and 6 hr later, she reported 23-ft seas and 43-ft swells. The 11,643-ton American barge KENAI broke tow, on the 15th, and sank near 56°N, 135°W on the 16th. The storm moved inland near Yakutat, on the 16th, and continued eastward across Canada.

This was a short-lived coastal storm which did not survive the open sea. It formed, early on the 18th, in the Sea of Japan, on a front that extended from near the North Pole, across the Sea of Okhotsk, to North Korea. The storm moved through La Perouse Strait, deepening as it crossed the Sea of Okhotsk. By 1200 on the 19th, the storm had crossed the Kamchatka Peninsula and its central pressure was 974 mb. Island stations along the Kurils reported 35- to 45-kt gales. The DAIGOH MARU was hit by 40-kt winds, far south of the center near 42.5°N, 160°E, and the MEISHON MARU, nearer the center, had 45-kt gales.

The LOW was moving northeastward very slowly with the front moving eastward out ahead of it. At 0000 on the 20th, the highest winds were reported. The 974-mb center was near 54°N, 164°E. About 250 mi south of the center, near 50°N, 166°E, the MONTIRON was fighting 60-kt westerly winds. Far to the south near 42°N, 174°E, and ahead of the front, the HARBOUR BRIDGE was headed westward into 50-kt winds with an obscured sky and heavy drizzle. This was accompanied by 13-ft seas and 20-ft swells.

Later on the 20th, the LOW started filling and became a long/narrow trough stretching southeastward toward another LOW that had been idling in the central ocean. Several ships north of the Aleutians reported gale-force easterly winds. On the 21st, all that remained was a trough that extended westward from the new LOW, near 49°N, 163°W. There was a strong band of winds from the Kamchatka Peninsula to 35°N, south of the center.

The LOW referred to above was also generated on the 18th, in midocean. It quickly developed a good circulation and gale-force winds, by 0000 on the 19th, as the CANADA MARU and MORI MARU could attest. The LOW was moving very slowly east-northeastward. At 0000 on the 20th, the NEBULA was sailing eastward with 40-kt westerlies and 23-ft swells. At 1200, there were no reports, but at 0000 on the 21st, there were many with the 970-mb LOW. The PLUTOS won the award for the highest, at 55 kt, southwest of the center near 44°N, 179°E. Ships as far south as 38°N reported 45-kt winds. Far out east of the center, O-

cean Station Vessel "P" measured 40-kt southerly winds ahead of the front.

At 0600 on the 21st, the PEARL VENTURE was at 45.3°N, 175.8°E, between two LOW centers. She was actually closer to the western one, but the 45-kt measured wind was from 300°, as were the 20-ft seas and 36-ft swells. The storm was turning northward and tracked into Bristol Bay on the 22d.

This contribution from Manchuria originated on an old weak frontal system that had fought its way across the high pressures of the Asian continent. The frontal wave moved over the Sea of Japan on the 20th. At 0000 on the 21st, it was a 986-mb LOW over the Kuril Islands with gales in the southern quadrant. At 1200, the HARUNA MARU was contending with 45-kt strong gales at 41°N, 158°E, while the HOZAN MARU farther west fought 23-ft swells with winds 5 kt lighter.

That was only a taste of what was to come. At 0000 on the 22d, the HOEGH MIRANDA (42.5°N, 171°E) and the ZIM NEW YORK (40°N, 169°E) both fought 50-kt storm winds with thunderstorms and 16-ft seas. At 1200 the highest wind plotted was 45 kt by the TAKAO MARU. This was surely due to a lack of radio officers on duty as the 0000 chart of the 23d was loaded with high wind reports. The highest wind reported for the month was at this time -- 65 kt from the west-northwest by the EASTERN WORLD -- near 45°N, 176°W, with a heavy thunderstorm and hail. The LEO also measured 65 kt, at 45.4°N, 157°W, and 30-ft waves. The EXPORT COURIER was only slightly better off with 55-kt winds, 16-ft seas, and 23-ft swells. The PLUVIS (38°N, 175.7°W) fought 48-kt gales, with 23-ft seas and 33-ft swells tearing at her. Not far away, at 44°N, 172°W, the PHILIPPINE MAIL was fighting 60-kt westerly winds combined with 15-ft seas and 28-ft swells. The swells were 40° off the wind seas. About 100 mi directly south of the 956-mb center, the PEARL VENTURE was tossed in all directions by 55-kt westerly winds blowing 13-ft seas and 25-ft swells out of the south. The HOEGH MIRANDA was still battling 55-kt winds. Far out ahead of the storm, the EASTERN BUILDER, near 47.5°N, 156.5°W, was headed south into 55-kt southerly winds. The high winds covered an area of over 1,500 mi in diameter with the greatest concentration in the southwestern quadrant.

On the 24th, the 961-mb LOW was headed toward the Gulf of Alaska. The ALASKA MARU was bounced by 50-kt storm winds. Seas of 10 to 15 ft and swells to 25 ft were common reports south of the center. The EXPORT COURIER, at 37.9°N, 160.3°W, reported 32-ft swells. Later in the day, the center broke up into several centers as it moved toward Kodiak Island. One of these subcenters became the primary circulation over Bristol Bay, on the 25th, where it dissipated.

This storm also had Asian ancestry. It came out of North China, across Manchuria, and into the Sea of Japan on the 22d. At 1200, a weather station east of Vladivostok reported 35-kt northerly winds. At this same time another LOW was tracking northeastward from south of Honshu. The first gale-force winds were with this southerly LOW, on the 23d, but at about that time it sped eastward under the influence of the zonal flow.

On the 24th, Ostrov Urup reported 40-kt gales and the DAIKI MARU at 43.6°N, 155.9°E was rocked by 35-kt gales, 12-ft seas, and 16-ft swells. At 1200, the 981-mb LOW was near 45.5°N, 157.5°E. Southwest of the center, near 43.5°N, 154.5°E, the CHIDORISAN MARU was fighting 55-kt starboard winds with 13-ft seas and 23-ft swells. About 150 mi south of the center, the SHINKO MARU, and about 200 mi west of the center another ship, were tossed by 40-kt gales. As the other LOW raced eastward and a HIGH moved off the continent the surface LOW jumped eastward and dissipated into the major cyclonic circulation on the 25th.

This was the LOW, from south of Japan, mentioned in the previous storm account. It formed at 0000 on the 22d, south of Kobe. By 1200 on the 24th, it was moving around the south side of an old LOW over Bristol Bay. During this time it was relatively weak as it raced eastward and then northeastward. It was not until midday on the 26th, when it developed deep upper-air support and slowed in forward speed, that the surface LOW deepened. It treated Ocean Station Vessel "P" to 45-kt gales as it passed about 150 mi to the northwest. At 0000 on the 27th, the 973-mb center was near 54°N, 144°W, and "PAPA" was still on the receiving end of 45-kt winds with 26-ft seas. The MOBILE, near the coast at 55.5°N, 138°W, had 45-kt southeasterlies north of the occlusion.

The central pressure (970 mb) continued to drop as the storm inched northward at 1200 on the 27th. The USCGC RUSH was about 300 mi south of the center headed northwestward and fighting 60-kt southwesterly winds and 30-ft swells. The seas figure could not be read due to the analysis lines. Southwest of the center the OREGON MAIL had mild 40-kt winds and only 12-ft seas and 16-ft swells. By the 28th, the LOW was filling as rapidly as it deepened. An old quasi-stationary LOW near Bristol Bay absorbed part of the circulation, and on the 29th both LOWs were

During the later part of this month almost each LOW that entered the Gulf of Alaska was a severe storm. This was the circulation that absorbed the previous storm.

On the 27th, the midlatitudes (25° to 45°N) were dominated by two HIGHs, one near 160°E and the other near 160°W. A LOW formed in the col area between them, near 35°N, 180°. The HIGHs were moving eastward at a fairly high rate of speed and the LOW moved northeastward, deepening and expanding the cyclonic circulation. By 0000 on the 29th, it had a central pressure of 976 mb at 48.5°N, 157.5°W. It had started out at about 1012 mb. The PACIFIC BEAR, at 44.7°N, 162.8°W, was sailing into 45-kt northwesterly winds. Ocean Station Vessel "P" had 40-kt winds from the south, just prior to passage of the cold front. The pressure had dropped 6.8 mb during the past 3 hr. On the 0000 chart of the 30th, there were many ship reports to locate the 954-mb center near 54.5°N, 149°W. The maximum wind reported was 45 kt by the PACIFIC LOGGER and the WAKANESAN MARU. Waves up to 25 ft were being reported. At 1200, the FYODOR KRAYNOV was near 55°N, 153°W, with 60-kt winds from the northwest. She was also reporting 20-ft seas and 39-ft swells. To the south, OSV "P" was still fighting 25-ft seas but the winds were only

35 kt. Near the coast off Yakutat, EB-33 was reporting lighter easterly winds. Later on the 30th, the storm followed the pattern of the others and started to fill rapidly as it neared the coast. On the 31st, there were a few gale-force winds, but by the end of the day a center no longer existed.

Late on the 27th, a LOW was analyzed east of northern Honshu. It moved northward toward Kamchatka and, at 1200 on the 28th, was 978 mb. The BEL HUDSON was just behind the cold front, at 38.5°N, 157°E, with 50-kt winds. The POLAR ALASKA suffered 58-kt winds at 47.5°N, 158.3°E. Twelve hours later, the JUJO MARU had 50-kt winds and accompanying seas rolling in on her starboard side. On the 30th, a new center developed on the occluded front well east of the main LOW. The circulation could not support this division of energy, and the original LOW vanished on the 31st.

This low-pressure system is traceable all the way from the Balkans. On the 30th, it starts to rejuvenate over Manchuria. By 1200 on the 31st, it was a 986-mb LOW over Sakhalin Island. At 1200 November 1, the first gale-force winds were observed. By 0000 on the 2d, the LOW had crossed the Kuril Islands and was 968 mb. At that time, Ostrov Simushir measured 70-kt northwesterly winds. There were two 50-kt ship reports, the DAIKI MARU (44°N, 160.5°E) and the KANEOKA MARU (44.5°N, 158°E). The latter also reported 10-ft seas and 30-ft swells.

At 1200, the island was still measuring 55-kt winds. The GOLDEN ARROW, near 45.5°N, 161.5°E, was slowly traveling southwestward with 45-kt westerly winds, 20-ft seas, and 26-ft swells. To the north of the center, Ostrov Beringa was measuring 50-kt easterly winds. For the last several days there had been indications of a double LOW system, but by the 3d only a single center could be detected. Gale-force winds were blowing from 40° to 55°N and 155°E to 170°W. At this time the 973-mb center was moving eastward almost directly over the Aleutian Islands.

On the 3d, a secondary LOW formed in the southeast quadrant. It moved northeastward into the Gulf of Alaska as the main LOW moved along the islands. By the 5th, the new LOW had taken over the circulation and the original LOW disappeared.

Tropical Cyclones, Western Pacific -- It was black October in the Philippines. In one of the greatest onslaughts in recorded weather history, four typhoons battered Luzon helpless. The island was continually besieged by typhoon winds and torrential rains. When it was all over, more than 1 1/2 million people were left homeless. Crops were so badly damaged that valuable sugar exports were halted. Death and damage figures are still sketchy.

Typhoons are nothing new to the Philippines--they get clobbered almost every year. However, a succession of storms in such a short period of time is unusual. During the previous 21 Octobers, a total of nine typhoons have moved through the Luzon region (15° to 20°N, 120° to 125°E).

All the typhoons were spawned and nurtured in the Philippine Sea. Bess was detected, on the 8th, about 250 mi northwest of Yap Island. She moved westnorthwestward, developing slowly. Bess reached typhoon strength, on the 10th, just about 100 mi east of Luzon. Winds of 40 kt were encountered by the AMERICAN LANCER some 400 mi from the huge storm's center. Bess generated 75-kt winds near her center as she moved westward into Luzon early on the 11th. Vigan on the west coast was reporting 45-kt winds from the north-northwest; they switched to the south-southwest at 45 kt as Bess moved out into the South China Sea. She remained at typhoon strength until the 13th. Then as a tropical storm moving westward she crossed Hainan, and landed on the coast of North Vietnam as a depression on the 14th. The 11th and 12th were bad days for ships. The SANTA CRUZ (4,347 tons) dragged anchor in Manila Bay and ran aground. The DAO (3,587 tons), in tow due to engine trouble, put into San Fernando and also dragged her anchor. She struck a wharf and subsequently grounded. The Monrovian-registered KINABALU ENAM (4,531 tons) ran aground at 24.2°N, 120.5°E. Part of her deck cargo was washed overboard. She was abandoned by the crew, and salvage attempts were hindered by bad weather. The Yugoslavian 10,562-ton KOSOVO drifted aground, on the 12th, after engine failure, near 20.7°N, 116.7°E.

This was the same day that Carmen sprang to life near 12°N, 130°E. Carmen moved northwestward as she intensified. By the 16th, she was a typhoon with 65-kt sustained winds occasionally gusting to about 80 kt. At this time, Carmen was about 200 mi east of Manila and only a little over 100 mi from landfall on the east coast of Luzon. The center of the large circulation moved ashore late on the 16th. She dropped back to tropical storm strength crossing the rugged island. However, once over the friendly waters of the South China Sea, Carmen reintensified to typhoon strength by the 17th. She had been moving on a west-northwestward track since coming off Luzon, but, on the 17th, she turned more toward the northwest. Maximum sustained winds built to near 80 kt, with gales extending out 200 to 300 mi from the center, on the 18th. An unidentified ship encountered 50-kt winds within 50 mi of the center as Carmen headed for mainland China. On the 19th, she moved inland about 60 mi west-southwest of Hong Kong.

Two days later, up popped Della, right near Carmen's birthplace. Della developed slowly. She moved northwestward as a tropical storm, until the 22d, when she turned northward and reached typhoon intensity. By this time Della was about 100 mi east of Luzon's northeastern tip. Della suddenly turned westward, then west-southwestward, and ploughed through the Babuyan Islands, just off Luzon's north coast, on the 23d. Winds near her center were up to 70 kt, and northern Luzon was pelted with torrential rains blown by 50-kt winds. The typhoon swung westward on the 24th. Maximum winds climbed to 85 kt during the following day. However, Della began to weaken as she neared Hainan late on the 25th. As she crossed the Island, winds dropped to tropical storm strength. She continued westward across the Gulf of Tonkin and moved into North Vietnam near Thanh Hoa -- close to where Bess had landed earlier.

While Della was on her junket through the South China

(Continued on page 116.)

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

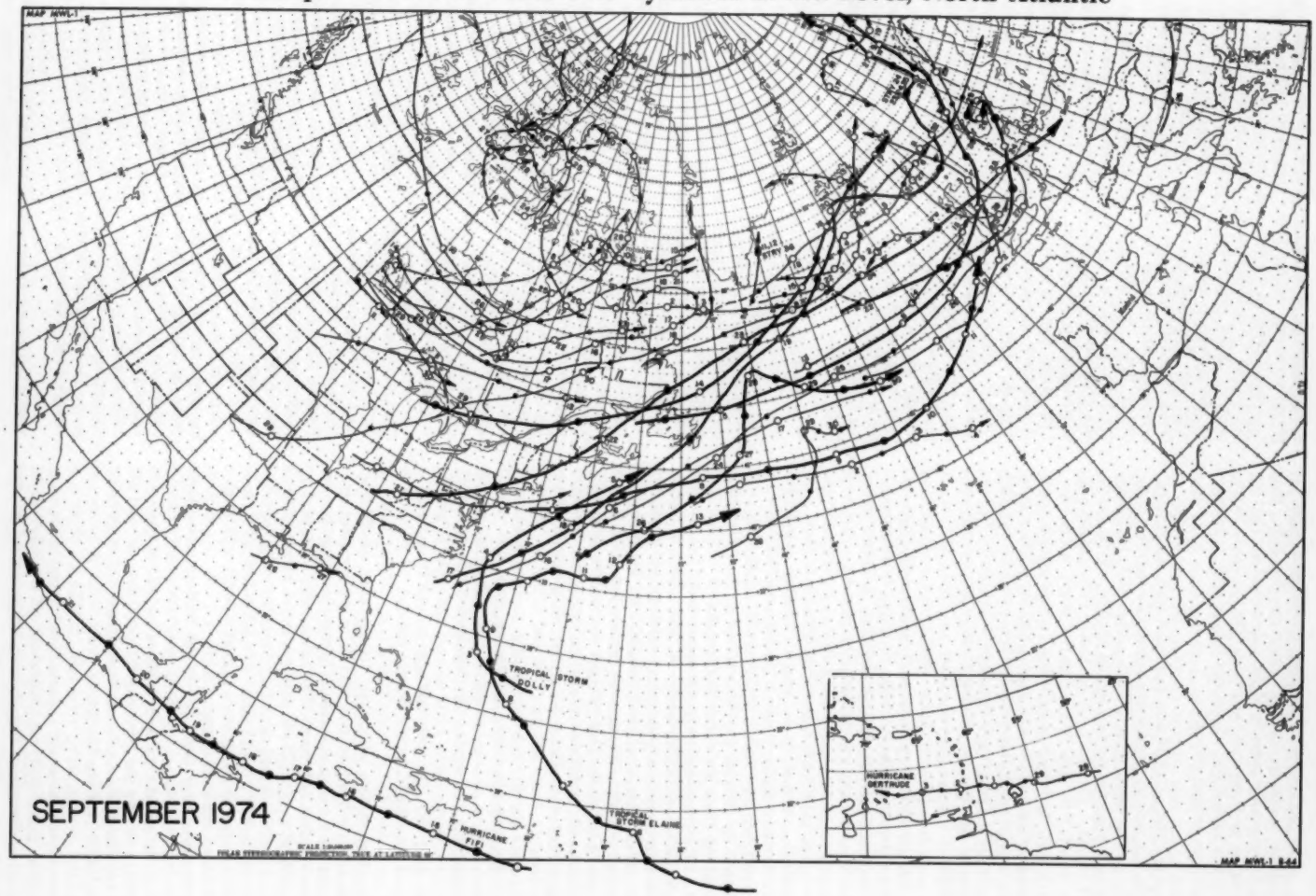

Figure 28.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

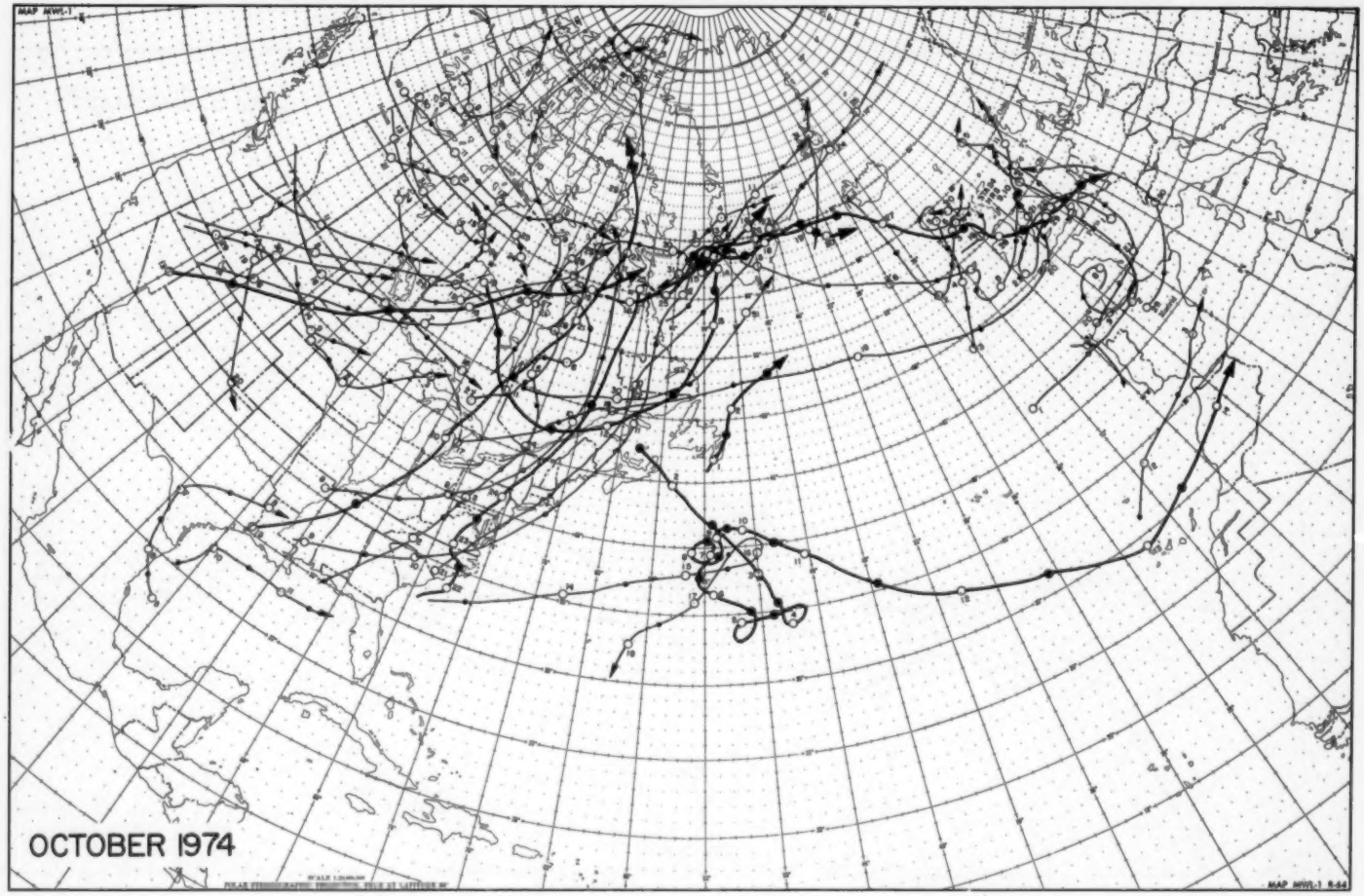

Figure 29.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

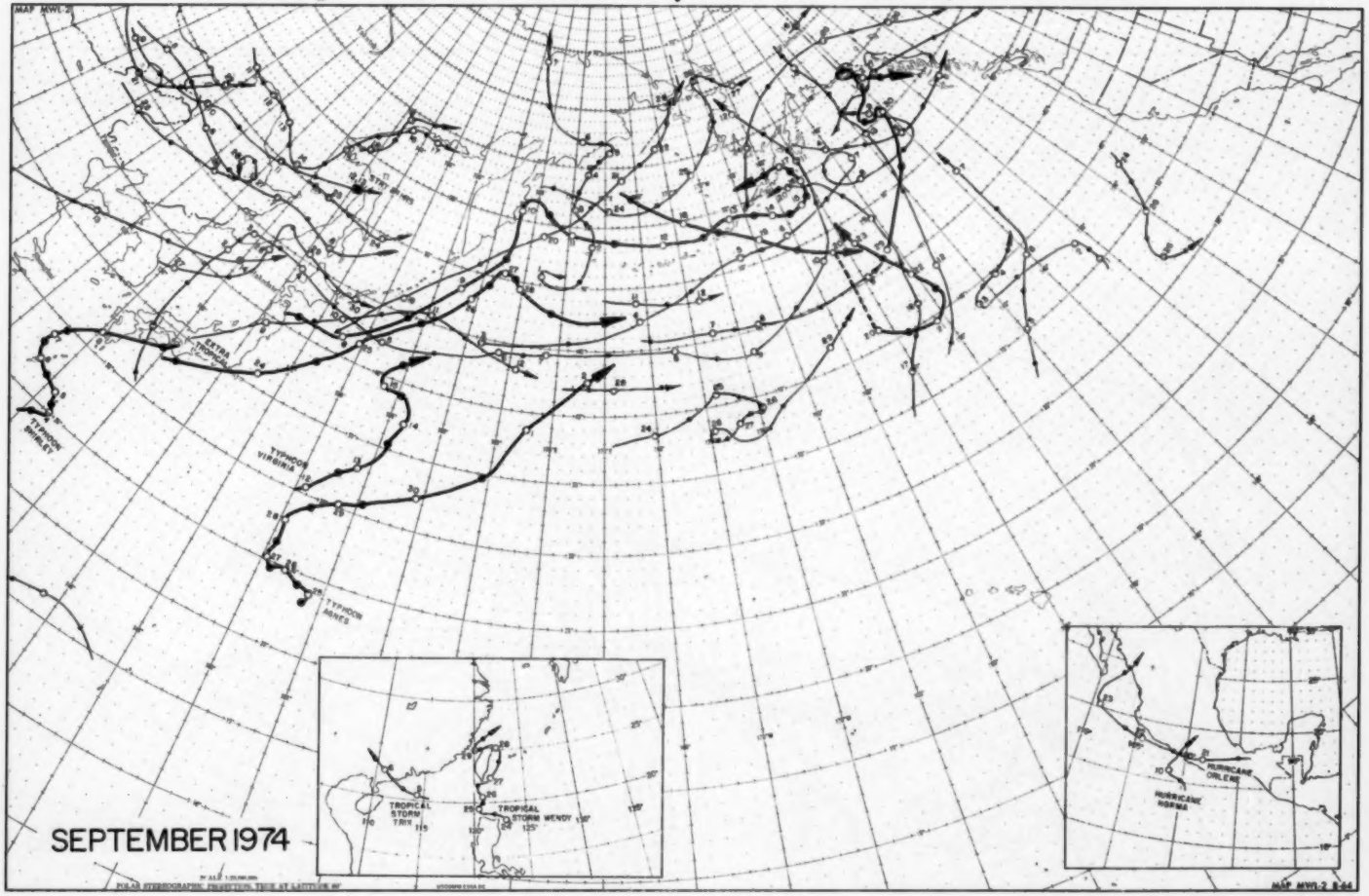

Figure 30.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

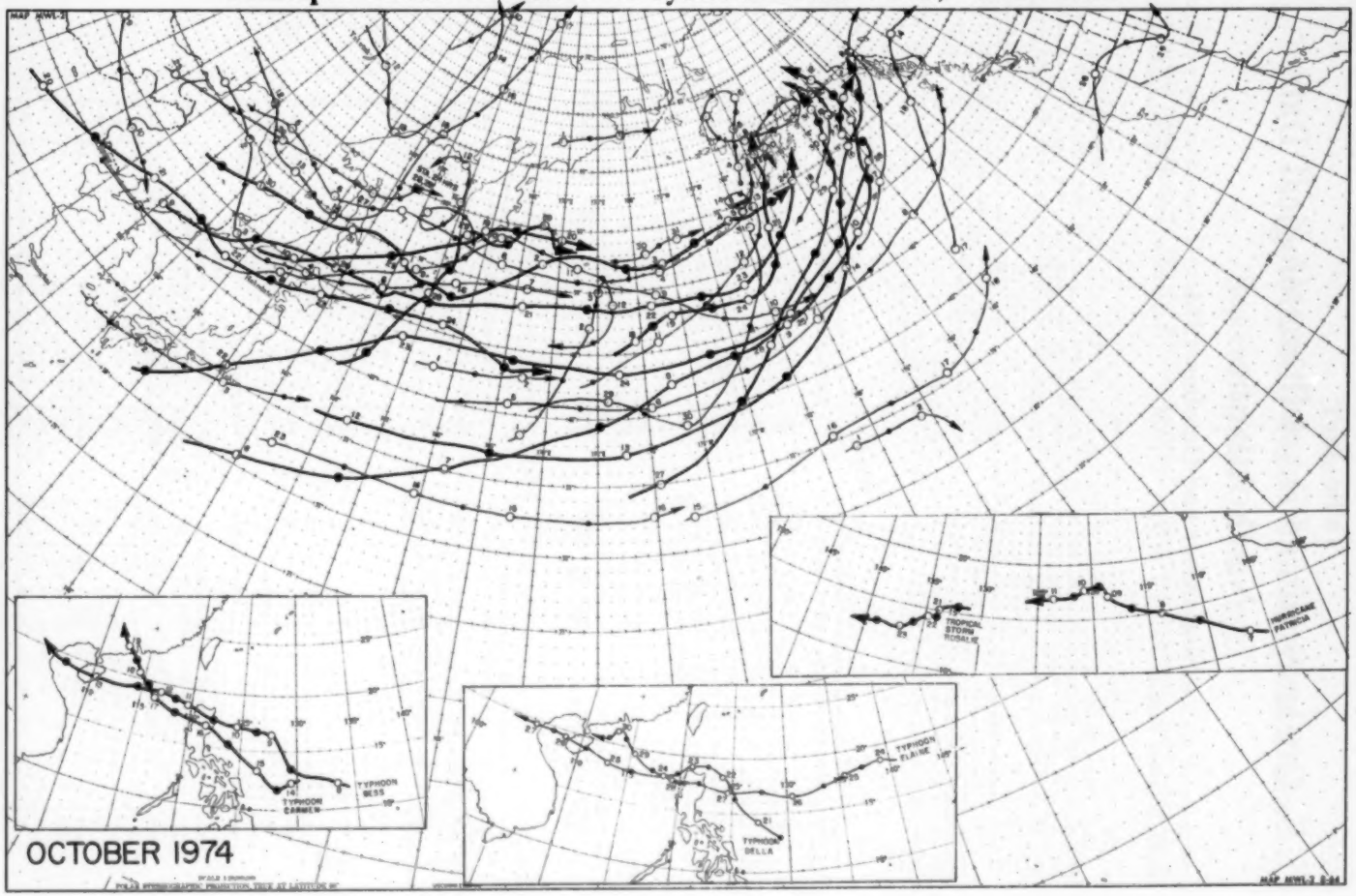

Figure 31.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Table 8

U. S. Ocean Station Vessel Climatological Data, North Atlantic

September and October 1974

Ocean Weather Station 'HOTEL' 38°00'N 71°00'W **September and October, 1974**

MEANS AND EXTREMES

MONTH	DRY BULB TEMP (°C) MIN	DA HR	MEAN	MAX	DA HR	DEW-POINT TEMP (°C) MIN	DA HR	MEAN	MAX	DA HR	SEA TEMP (°C) MIN	DA HR	MEAN	MAX	DA HR	AIR-SEA TEMP DIFFERENCE (°C) MIN	DA HR	MEAN	MAX	DA HR
SEPT	16.0	24 06	23.8	29.7	03 15	8.8	24 06	18.8	23.1	01 15	23.3	29 00	26.4	28.4	420 21	-10.4	29 06	- 2.6	2.0	07 15
OCT	8.1	21 15	17.9	24.1	13 15	.8	22 03	11.3	21.2	15 15	19.6	420 09	21.9	23.0	01 00	-14.2	21 00	- 4.0	3.1	13 15

MONTH	MEANS AND EXTREMES PRESSURE (MB) MIN	DA HR	MEAN	MAX	DA HR	PERCENTAGE FREQUENCY OF CLOUD AMOUNT (OKTAS) TOTAL CLOUD 0-2	3-5	6-7	8 & OBSC	LOW CLOUD 0-2	3-5	6-7	8 & OBSC	DAYS WITH SPECIFIED WEATHER RAIN OR DRIZ PCPN	SNOW	THDR	TSTM	VSBY <1KM **	WIND (KTS) ≥34	≥48	≥64	COMP OB DAYS	LOBS WITH PCPN	NO OF OBS
SEPT	1005.6	30 06	1017.3	1028.9	24 06	10.5	28.1	38.9	19.9	39.9	41.6	14.5	4.1	22	21	0	7	0	2	0	0	27	11.5	291
OCT	1009.8	20 03	1022.0	1034.9	22 12	30.8	23.5	29.5	20.2	49.0	29.6	13.8	9.7	13	13	0	1	0	2	0	0	29	9.9	247

** VV-00-03 AND/OR 0-4 COMP OB DAYS-COMPLETE OB DAYS

Wind

SEPT WIND DIRECTIONS AND SPEEDS (% FREQUENCIES)

DIR	WIND SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL	MEAN SPEED
N	.4	3.2	9.9	5.1	.9	.0	19.0	18.0
NE	.4	3.8	14.9	6.1	.1	.0	24.2	19.4
E	.9	1.9	3.4	.3	.0	.0	6.5	10.4
SE	.0	1.9	2.0	.2	.0	.0	4.7	13.2
S	.0	3.9	3.9	4.3	.0	.0	12.1	18.4
SW	.0	3.0	7.9	5.8	.0	.0	16.8	17.9
W	.0	2.1	4.9	.0	.4	.0	7.4	15.6
NW	.0	2.7	8.5	1.2	.0	.0	12.4	13.4
CALM	3.9	.0	.0	.0	.0	.0	3.9	.0
TOTAL	5.0	22.3	40.9	22.5	.9	.0	100.0	15.7

NUMBER OF OBS 291 — MAX WIND DIR 280, SPEED 54, DA HR 22 0600 — VECTOR SPEED 2.1 — MEAN DIR 348 — (DIR IN DEGREES)

OCT WIND DIRECTIONS AND SPEEDS (% FREQUENCIES)

DIR	WIND SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL	MEAN SPEED
N	1.1	4.9	14.9	10.4	.0	.0	31.0	17.7
NE	.1	3.2	5.0	1.5	.0	.0	9.8	14.8
E	.7	3.8	9.1	.8	.0	.0	11.9	13.3
SE	.4	.2	.9	.8	.0	.0	1.9	9.9
S	.8	1.9	.4	.8	.0	.0	2.9	9.8
SW	.0	2.9	5.9	1.2	.0	.0	9.8	14.8
W	.0	3.2	6.1	.0	.0	.0	9.3	12.8
NW	.1	3.5	11.8	6.7	.0	.0	23.8	16.3
CALM	2.0	.0	.0	.0	.0	.0	2.0	.0
TOTAL	4.5	20.7	49.0	19.8	.0	.0	100.0	14.9

NUMBER OF OBS 247 — MAX WIND DIR 240, SPEED 39, DA HR 17 0434 — VECTOR SPEED 8.3 — MEAN DIR 348 — (DIR IN DEGREES)

Wave

SEPT WAVE DIRECTIONS AND HEIGHTS (% FREQUENCIES)

DIR	WAVE HEIGHT (METERS) <1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	TOTAL
N	.4	.4	4.2	1.4	.9	.0	.0	.0	6.9
NE	.4	6.6	11.9	3.5	.8	.0	.0	.0	23.0
E	.0	8.8	3.9	2.6	.8	.0	.0	.0	15.9
SE	.0	3.2	2.8	.6	.8	.0	.0	.0	6.7
S	.0	1.7	4.8	3.2	.8	.0	.0	.0	9.7
SW	.0	7.6	2.7	4.9	.8	.0	.0	.0	15.2
W	.0	1.8	.8	.9	.8	.0	.0	.0	3.9
NW	.4	3.5	1.8	1.5	.0	.0	.0	.0	9.1
IND	.8	5.6	0.5	.0	.0	.0	.0	.0	12.1
CALM	.0	.0	.0	.0	.0	.0	.0	.0	.0
TOTAL	1.3	41.1	39.0	18.6	.0	.0	.0	.0	100.0

NUMBER OF OBS 291 — IND=INDETERMINATE

OCT WAVE DIRECTIONS AND HEIGHTS (% FREQUENCIES)

DIR	WAVE HEIGHT (METERS) <1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	TOTAL
N	.0	14.8	8.8	7.8	.8	.0	.0	.0	32.2
NE	.1	6.6	2.4	.7	.0	.0	.0	.0	9.8
E	.3	6.9	.8	.0	.0	.0	.0	.0	7.1
SE	.0	4.7	.0	.0	.0	.0	.0	.0	4.7
S	1.2	1.4	1.0	.0	.0	.0	.0	.0	3.6
SW	.0	4.8	.7	1.2	.0	.0	.0	.0	6.7
W	.0	3.2	2.1	.0	.0	.0	.0	.0	5.4
NW	.0	6.4	6.8	3.2	.4	.0	.0	.0	16.8
IND	.0	13.0	.8	.0	.8	.0	.0	.0	13.8
CALM	.0	.0	.0	.0	.0	.0	.0	.0	.0
TOTAL	1.6	80.7	23.3	13.0	1.2	.8	.0	.0	100.0

NUMBER OF OBS 247 — IND=INDETERMINATE

SEPT WAVE PERIODS AND HEIGHTS (% FREQUENCIES)

PERIOD IN SECONDS	WAVE HEIGHT (METERS) <1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	TOTAL
<6	1.3	13.9	7.4	.9	.0	.0	.0	.0	23.4
6-7	.0	18.2	19.5	12.1	.0	.0	.0	.0	49.8
8-9	.0	9.5	5.6	9.6	.0	.0	.0	.0	14.7
10-11	.0	.0	.0	.0	.0	.0	.0	.0	.0
12-13	.0	.0	.0	.0	.0	.0	.0	.0	.0
>13	.0	.0	.0	.0	.0	.0	.0	.0	.0
IND	.0	9.0	9.5	.0	.0	.0	.0	.0	12.1
TOTAL	1.3	41.1	39.0	18.6	.0	.0	.0	.0	100.0

NUMBER OF OBS 291 — MAX WAVE HEIGHT: HGT 9.9, PER 9, DIR 190, TYPE SWL, DA HR 04 21 — IND=INDETERMINATE — (DIR IN DEGREES)

OCT WAVE PERIODS AND HEIGHTS (% FREQUENCIES)

PERIOD IN SECONDS	WAVE HEIGHT (METERS) <1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	TOTAL
<6	.8	22.7	3.2	.4	.0	.0	.0	.0	27.1
6-7	.0	14.9	16.0	12.8	1.2	.0	.0	.0	47.0
8-9	.8	8.5	2.8	.8	.0	.0	.0	.0	12.1
10-11	.0	.0	.0	.0	.0	.0	.0	.0	.0
12-13	.0	.0	.0	.0	.0	.0	.0	.0	.0
>13	.0	.0	.0	.0	.0	.0	.0	.0	.0
IND	.0	13.0	.8	.0	.0	.0	.0	.0	13.8
TOTAL	1.6	80.7	23.3	13.0	1.2	.0	.0	.0	100.0

NUMBER OF OBS 247 — MAX WAVE HEIGHT: HGT 4.0, PER 7, DIR 350, TYPE SWL, DA HR 04 18 — IND=INDETERMINATE — (DIR IN DEGREES)

*ALSO OCCURRED ON PREVIOUS OBSERVATIONS

For each observation, the higher wave of the sea/swell group was selected for summarization; if heights were equal, the wave with the longer period was selected; if periods were also equal, the sea wave was used.

Table 9
U.S. Ocean Buoy Climatological Data
September and October 1974

Beginning with the January 1975 issue, Monthly Ocean Buoy Climatological Data will be summarized and appear at this position in the "Marine Weather Review." Ocean Weather Station "Hotel" will also be summarized when available.

SEPTEMBER DATA SUMMARY 8813
AVERAGE LATITUDE 29.0N AVERAGE LONGITUDE 094.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	24.6	(07 03)	28.9	32.9	(23 18)	238	30
DEWPOINT TEMP (DEG C)	19.4	(30 21)	23.9	26.2	(19 06)	238	30
PRESSURE (MBAR)	1009.4	(07 09)	1011.7	1019.0	(11 03)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS) 1-	11-	22-	34-	TOTAL	MEAN SPEED	NO. OF OBS: 238
DIR	10	21	33	47		(KNOTS)	
N	.8	5.0	7.6		14.3	19.7	MAX WIND
NE	1.3	4.2	1.3		7.1	14.1	SPEED: 33 KNOTS
E	10.1	21.0	1.3		32.8	12.5	DIRECTION: 200 DEG
SE	9.2	8.4			17.6	12.1	DAY: 11
S	8.8	8.0	.8		17.6	14.2	HOUR: 03
SW	2.1	1.7			3.8	9.8	
W	.8	2.0	1.3	.4	4.9	12.9	
NW	1.7	5.0	2.9		9.6	10.7	
CALM							
TOTAL	24.9	49.0	24.2	13.9	100.0	14.0	

PRECIPITATION
NO. OF DAYS WITH PRECIP: 13 NO. OF DAYS WITH REPORTS/ COMPLETE: 28 PARTIAL: 2
NO. OF OBS WITH PAST OR PRESENT PRECIP: 18 NO. OF WEATHER OBS: 238

OCTOBER DATA SUMMARY 8813
AVERAGE LATITUDE 29.0N AVERAGE LONGITUDE 094.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	20.8	(17 12)	28.4	34.6	(14 10)	248	31
DEWPOINT TEMP (DEG C)	11.6	(17 12)	19.1	24.0	(29 15)	248	31
PRESSURE (MBAR)	1009.9	(29 00)	1018.9	1030.1	(29 03)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS) 1-	11-	22-	34-	TOTAL	MEAN SPEED	NO. OF OBS: 248
DIR	10	21	33	47		(KNOTS)	
N	8.9	4.8	1.6		15.3	12.0	MAX WIND
NE	9.3	10.1			19.4	12.1	SPEED: 27 KNOTS
E	9.3	24.7			40.3	14.7	DIRECTION: 170 DEG
SE	4.0	10.5	2.4		16.9	15.0	DAY: 28
S		9.2	3.2		9.1	19.2	HOUR: 12
SW							
W							
NW	.8	1.2	.4		2.0	8.0	
CALM							
TOTAL	.4	27.0	69.7	2.9	100.0	14.2	

PRECIPITATION
NO. OF DAYS WITH PRECIP: 8 NO. OF DAYS WITH REPORTS/ COMPLETE: 31 PARTIAL: 0
NO. OF OBS WITH PAST OR PRESENT PRECIP: 18 NO. OF WEATHER OBS: 248

SEPTEMBER DATA SUMMARY 8813
AVERAGE LATITUDE 32.3N AVERAGE LONGITUDE 079.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.1	(23 12)	25.8	31.1	(10 18)	239	30
DEWPOINT TEMP (DEG C)	16.5	(29 09)	23.1	26.3	(29 03)	239	30
SEA TEMP (DEG C)	26.4	(27 12)	28.2	34.0	(02 15)	239	30
AIR-SEA TEMP (DEG C)	-00.0	(03 00)	-01.4	02.1	(02 15)	239	30
PRESSURE (MBAR)	1008.4	(30 09)	1015.9	1019.3	(11 15)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS) 1-	11-	22-	34-	TOTAL	MEAN SPEED	NO. OF OBS: 239
DIR	10	21	33	47		(KNOTS)	
N	2.1	4.6	1.7	.8	9.2	9.4	MAX WIND
NE	1.7	4.6	3.3	4.6	14.2	14.6	SPEED: 28 KNOTS
E	.4	12.6	4.2		17.2	8.0	DIRECTION: 090 DEG
SE	1.7	13.0	4.9	.4	20.9	9.2	DAY: 04
S	2.1	9.6	9.0		19.7	8.7	HOUR: 18
SW	2.4	8.9	4.2		15.0	7.7	
W	.8	2.9	1.7		5.4	8.1	
NW	.4	2.1			2.5	6.3	
CALM	.8				.8	.0	
TOTAL	19.0	58.2	29.9	9.9	100.0	9.3	

PRECIPITATION
NO. OF DAYS WITH PRECIP: 12 NO. OF DAYS WITH REPORTS/ COMPLETE: 29 PARTIAL: 1
NO. OF OBS WITH PAST OR PRESENT PRECIP: 23 NO. OF WEATHER OBS: 239

OCTOBER DATA SUMMARY 8813
AVERAGE LATITUDE 32.3N AVERAGE LONGITUDE 079.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	19.4	(01 18)	25.7	31.1	(14 18)	247	31
DEWPOINT TEMP (DEG C)	09.3	(30 12)	16.2	20.8	(08 03)	247	31
SEA TEMP (DEG C)	24.9	(25 06)	26.2	29.0	(14 18)	237	31
AIR-SEA TEMP (DEG C)	-11.7	(21 18)	-03.7	01.1	(14 18)	237	31
PRESSURE (MBAR)	1006.8	(19 18)	1020.4	1029.2	(22 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS) 1-	11-	22-	34-	TOTAL	MEAN SPEED	NO. OF OBS: 247
DIR	10	21	33	47		(KNOTS)	
N	.4	8.9	15.8	6.9	30.9	16.9	MAX WIND
NE	1.7	8.1	15.0	8.1	30.9	16.1	SPEED: 32 KNOTS
E	.4	9.6	6.9	2.0	19.0	13.7	DIRECTION: 080 DEG
SE	.4	2.0	4.5	.8	7.7	12.8	DAY: 07
S	.4	1.2	1.2	1.6	4.9	15.8	HOUR: 00
SW		1.6	2.0		3.6	11.4	
W		1.6	.4	.4	2.4	10.9	
NW	.8	2.0	.8		3.6	11.8	
CALM							
TOTAL	3.6	27.9	49.8	18.6	100.0	14.6	

PRECIPITATION
NO. OF DAYS WITH PRECIP: 5 NO. OF DAYS WITH REPORTS/ COMPLETE: 30 PARTIAL: 1
NO. OF OBS WITH PAST OR PRESENT PRECIP: 12 NO. OF WEATHER OBS: 247

SEPTEMBER DATA SUMMARY 8832
AVERAGE LATITUDE 27.0N AVERAGE LONGITUDE 084.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	27.3	(03 12)	28.8	30.8	(16 18)	100	30
SEA TEMP (DEG C)	27.6	(10 06)	28.7	29.7	(03 18)	91	30
AIR-SEA TEMP (DEG C)	-01.7	(02 12)	-00.1	01.3	(03 18)	86	30
PRESSURE (MBAR)	1008.4	(27 00)	1014.7	1019.0	(29 12)	70	22

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS) 1-	11-	22-	34-	TOTAL	MEAN SPEED	NO. OF OBS: 96
DIR	10	21	33	47		(KNOTS)	
N	1.1	3.3			4.3	5.2	MAX WIND
NE		22.1	9.2		29.3	9.2	SPEED: 21 KNOTS
E	9.2	17.4	7.4		28.4	9.2	DIRECTION: 250 DEG
SE	1.1	7.4	3.2		11.6	7.6	DAY: 05
S	2.1	3.7	4.3		11.0	10.2	HOUR: 06
SW	1.1	4.2	4.2		9.5	9.8	
W	7.1	3.2	1.1		6.3	6.9	
NW		1.1			1.1	9.0	
CALM							
TOTAL	10.9	64.2	29.8		100.0	8.2	

OCTOBER DATA SUMMARY 8839
AVERAGE LATITUDE 27.0N AVERAGE LONGITUDE 084.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	22.0	(04 06)	26.4	27.0	(08 18)	114	31
SEA TEMP (DEG C)	29.4	(29 00)	29.7	30.7	(01 18)	106	31
AIR-SEA TEMP (DEG C)	-05.3	(04 12)	-01.7	01.0	(01 18)	104	31
PRESSURE (MBAR)	1014.9	(01 00)	1019.9	1023.7	(04 12)	17	5

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS) 1-	11-	22-	34-	TOTAL	MEAN SPEED	NO. OF OBS: 111
DIR	10	21	33	47		(KNOTS)	
N	9.0	11.7			20.7	13.1	MAX WIND
NE	9.4	30.0			39.0	14.2	SPEED: 23 KNOTS
E	9.0	29.1	.9		39.1	13.9	DIRECTION: 060 DEG
SE	.9	9.0			9.9	11.8	DAY: 02
S	.9	.9			1.8	10.5	HOUR: 18
SW		.9			.9	11.0	
W							
NW	.9				.9	9.0	
CALM							
TOTAL	.0	29.9	73.0	.9	100.0	13.0	

OCTOBER DATA SUMMARY 8833
AVERAGE LATITUDE 58.5N AVERAGE LONGITUDE 141.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.8	(30 00)	07.4	09.3	(26 18)	84	19
SEA TEMP (DEG C)	07.4	(31 21)	08.7	09.7	(19 00)	84	19
AIR-SEA TEMP (DEG C)	-03.2	(21 03)	-00.8	00.8	(19 00)	84	19
PRESSURE (MBAR)	0981.3	(30 03)	0996.8	1012.3	(17 21)	84	19

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS) 1-	11-	22-	34-	47-	TOTAL	MEAN SPEED	NO. OF OBS: 84
DIR	10	21	33	47	59		(KNOTS)	
N		1.2				1.2	6.0	MAX WIND
NW		2.3	11.0	7.0	4.7	25.0	22.0	SPEED: 39 KNOTS
E		9.5	10.1	9.3		27.9	19.9	DIRECTION: 100 DEG
SE		2.1	10.1			12.2	12.4	DAY: 30
SW	1.2	1.2	10.5	1.2		14.0	19.1	HOUR: 00
W		9.5	2.3			9.1	9.2	
NW								
CALM								
TOTAL	1.2	23.1	34.7	17.4	4.7	100.0	18.0	

Table 10
Selected Gale And Wave Observations, North Atlantic
September and October 1974

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves* Period sec.	Sea Waves* Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.*	Swell Waves Height ft.
NORTH ATLANTIC		SEP.																
MV PENNSPRING	NORWEGIAN	2	49.0 N	07.8 W	12	26	45		2 NM	81	987.8	14.5	16.0	XX	16.5	26	8	26
SS AMER ALLIANCE	AMERICAN	2	49.8 N	13.1 W	09	31	45		5 NM	01	990.0	13.4	16.7	10	14.5			
MV MAGLEBY MAERSK	DANISH	2	47.5 N	08.6 W	18	24	50		5 NM	02	1000.4	15.9				26	8	16.5
SS AMER ALLIANCE	AMERICAN	3	50.4 N	19.0 W	00	29	45		5 NM	01	1006.4	12.3	13.7	10	14.5			
SS AMER LEGACY	AMERICAN	7	49.1 N	08.3 W	06	27	48		5 NM	15	995.0	13.7	13.0	8	10	27	10	26
MV MOSGULF	NORWEGIAN	7	50.8 N	11.1 W	00	23	M 75		1 NM	92	976.0	14.0	13.0		19.5			
USCGC ACUSHNET	AMERICAN	7	29.8 N	88.6 W	12	04	M 44	(C)	2 NM	63	1008.5	23.0		3	6.5			
MV ESSO PHILIPPINES	PANAMANIAN	7	26.1 N	88.8 W	06	10	M 48	(C)	9 NM	81	1002.0	27.0	28.5	9	10	17	>13	13
SS AMER ACE	AMERICAN	8	45.1 N	49.9 W	18	03	45		9 NM	81	1000.5	11.7	16.2	8	16.5			
MV ATLANTICA LIVORNO	GERMAN	9	41.3 N	48.0 W	00	26	41		5 NM	02	994.2	18.0		11	10	24	>13	13
SS AMER TRADER	AMERICAN	9	38.0 N	36.4 W	18	27	45		9 NM	25	1002.8	21.7	23.8		14.5	27	10	24.5
SS EXPORT LEADER	AMERICAN	9	40.1 N	40.1 W	12	28	48		2 NM		998.2	20.0	23.2	9	16.5	27	12	19.5
SS ZIM NEW YORK	GERMAN	10	39.5 N	28.0 W	18	23	41		1 NM	64	1008.9	20.0	23.0			29	>13	29
SS AMER TRADER	AMERICAN	10	39.9 N	30.7 W	18	32	45		10 NM	02	1014.7	19.4	20.0	13	32	10		29.5
MV ATLANTICA LIVORNO	GERMAN	10	39.5 N	35.3 W	00	31	41		5 NM	02	998.3	17.8		10	11.5	30	>13	13
MV MOSGULF	NORWEGIAN	10	45.4 N	31.3 W	00	07	M 41		2 NM	92	993.0	16.0	17.0		21			
SS EXPORT LEADER	AMERICAN	10	38.7 N	39.9 W	00	29	45		2 NM		1004.0	20.0	22.2	9	14.3	28	12	18
SS AMER TRADER	AMERICAN	11	40.2 N	29.5 W	00	32	45		10 NM	02	1018.0	17.8	20.0	5	13	32	10	24.5
MV ALNERANTE	HONDURAN	18	16.8 N	83.8 W	18	12	64	(F)	50 VS	65	989.0	25.0	28.9	XX	19.5	XX		10
SS DOCTOR LYKES	AMERICAN	23	30.4 N	09.4 W	18	30	48		10 NM	01	985.4	14.5	13.8	5	8.5	23	8	10
SS AMER ARGOSY	AMERICAN	23	30.1 N	16.2 W	12	31	48		5 NM	02	1009.5	11.0	14.0	8	10	30	9	14.5
SS AMER ACE	AMERICAN	23	49.6 N	09.7 W	12	28	50		10 NM	03	997.6	13.5	14.5	6	13	28	6	16.5
MV SYLVO	NORWEGIAN	23	47.5 N	15.4 W	06	30	48		5 NM	02	1011.0	13.9		8	14.9			
SS CARRIBE TEXAS CITY	AMERICAN	24	34.0 N	78.8 W	06	02	45		5 NM	02	1022.0	20.0	27.8	2	13	02	< 6	19.5
SS DOCTOR LYKES	AMERICAN	24	49.7 N	04.9 W	00	28	49		10 NM	01	999.3	12.3	11.2	5	6.5	29	10	16.5
MV DAPHNE	SWEDISH	25	49.8 N	07.5 W	12	29	41		5 NM	03	1010.0	14.0	15.0			29	>13	24.5
SS AMER LEGEND	AMERICAN	25	48.9 N	07.8 W	12	30	50		5 NM	25	1004.2	13.9	13.3	7	18			
SS EXPORT FREEDOM	AMERICAN	26	42.5 N	34.5 W	18	07	45		1 NM	65	999.5	17.8	22.2	10	19.9			
MV DAPHNE	SWEDISH	27	51.1 N	20.1 W	18	31	42		5 NM	03	1018.5	9.8	14.0			31	12	19.5
MV MOSGULF	NORWEGIAN	27	41.0 N	51.7 W	00	19	M 52		5 NM	80	998.0	23.0	27.0		13			
GREAT LAKES VESSELS																		
SS GEORGE D GOBLE	AMERICAN	15	44.3 N	82.9 W	12	22	M 47		10 NM	03		13.0	17.0	5	5			
NORTH ATLANTIC		OCT.																
MV PLAN DE SAN LUIS	MEXICAN	3	19.5 N	95.7 W	06	32	48		2 NM	59	1016.5	25.5	28.0	8	14.5	32	12	5
SS ORE CHIEF	LIBERIAN	4	36.0 N	32.9 W	12	34	50		5 NM	03	1009.8	18.8	23.8	15	16.5	34	10	21
SS SOCONY VACUUM	AMERICAN	4	26.2 N	86.2 W	12	06	48	>	25 NM	02	1021.7	21.7	27.8	6	8	09	9	13
SS ALMERIA LYKES	AMERICAN	5	43.4 N	24.2 W	06	07	48		5 NM	02	1022.0	16.7	16.7	5	14.5	08	8	19.5
SS ORE CHIEF	LIBERIAN	5	38.5 N	29.5 W	12	07	60		2 NM	62	1008.5	19.3	22.3	10	24.5	34	13	29
SS MARJORIE LYKES	AMERICAN	5	27.8 N	79.7 W	15	05	48		1 NM	03	1015.2	23.3	24.5	7	19.5			
SS GULFCREST	AMERICAN	6	28.7 N	80.1 W	00	05	48		5 NM	03	1018.3	25.0	28.3	4	11.5			
USCGC COURAGEOUS	AMERICAN	6	26.1 N	78.0 W	00	03	M 42		5 NM	15	1010.8	25.7	27.7	9	13			
SS MARJORIE LYKES	AMERICAN	6	28.2 N	79.8 W	00	04	48		1 NM	64	1014.2	23.3	25.6	7	19.5			
SS SOCONY VACUUM	AMERICAN	6	28.6 N	79.9 W	12	04	45		2 NM	18	1013.2	22.8	27.8	6	14.5	03	9	23
MV CITADEL	SWEDISH	7	47.1 N	06.0 W	12	33	50		10 NM	03	1009.5	13.0	16.0	5	14.5			
SS GULFCREST	AMERICAN	7	32.9 N	78.2 W	00	04	45		5 NM	20	1018.3	23.3	26.7	5	10			
SS SOCONY VACUUM	AMERICAN	7	29.6 N	80.1 W	00	03	45		2 NM	18	1012.5	25.0	26.7	8	23	03	9	26
SS MOBIL LUBE	AMERICAN	8	35.3 N	74.9 W	18	02	45		5 NM	01	1014.9	19.0	23.0	6	16.5			
SS ZIM TOKYO	GERMAN	12	42.8 N	53.6 W	12	33	45		10 NM	51	1019.1	13.3	20.0	4	19.5			
MV ATLANTIDE	SWEDISH	16	38.6 N	33.5 W	12	01	50		5 NM	81	1018.0	20.2	20.0	8	13			
MV ATLANTIDE	SWEDISH	17	39.8 N	30.0 W	00	07	45		5 NM	81	1018.0	21.5	21.0		13			
MV MOSGULF	NORWEGIAN	20	41.2 N	59.0 W	18	25	M 45		5 NM	03	1007.0	19.0	22.0		16.5			
SS WARRIOR	AMERICAN	20	41.2 N	60.5 W	18	27	35		5 NM	07	1004.7	15.0	23.8	6	14.5	27	8	24.5
SS SANTA ANA	AMERICAN	23	18.4 N	68.2 W	00	03	45		1 NM	21	1015.0	26.1	27.8	6	10			
SS LOS ANGELES	AMERICAN	24	41.9 N	56.2 W	18	31	48		5 NM	02	1009.8	13.4	21.1	5	8	33	8	16.5
GREAT LAKES VESSELS																		
SS JOHN SHERWIN	AMERICAN	17	46.7 N	84.8 W	12	35	M 44		10 NM	02		4.0	11.0	5	6.5			

* Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

(C) Hurricane Carmen
(F) Hurricane Fifi

NOTE: The observations are selected from those with winds ≥ 35 kt or waves ≥ 25 ft from May through August (≥ 41 kt or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest wind speed was selected.

Table 11
Selected Gale And Wave Observations, North Pacific
September and October 1974

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb	Temperature °C Air	Temperature °C Sea	Sea Waves* Period sec.	Sea Waves* Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.*	Swell Waves Height ft.
NORTH PACIFIC		SEP.															
SS STELLA LYKES	AMERICAN	1	36.2 N	144.6 E	00	09	N 43 (P)	5 NM	02	1009.0	26.7	26.7	6	10	13	9	10
MV PEARL VENTURE	LIBERIAN	1	53.0 N	179.2 W	06	18	N 41	2 NM	04	1003.0	8.5	7.0	7	10			
SS SGT ANDREW MILLER	AMERICAN	11	39.1 N	124.3 W	06	34	42	5 NM	02	1011.9	15.6	15.0	7	6.5	34	12	11.5
MV VAN TRIUMPH	LIBERIAN	12	50.8 N	169.2 W	18	12	N 42	.25 NM	02	989.0	10.0	10.0					
MV GOLAR ARROW	LIBERIAN	13	44.5 N	152.9 E	12	04	N 48 (V)	.25 NM	28	1000.0	23.0	23.0	5	14.5			
SS SUMMIT	AMERICAN	13	53.2 N	171.5 W	12	36	48	1 NM	03	987.3	7.8	10.0	6	14.5	34	10	19.5
SS PRES VAN BUREN	AMERICAN	14	38.6 N	154.4 E	00	35	48 (V)	9 NM	02	1007.1	23.8	23.3			03	7	23
MV VAN FORT	LIBERIAN	14	51.6 N	169.3 W	06	24	N 45	5 NM	02	999.1	9.0	10.0	14	36	06	>13	10.5
SS OREGON MAIL	AMERICAN	15	38.6 N	153.6 E	06	35	55 (V)	5 NM	02	999.7	22.3	20.0	8	10	29	>13	10.5
SS OREGON MAIL	AMERICAN	17	45.6 N	168.6 E	00	13	30	2 NM	12	1017.5	11.7	8.3	8	11.5	19	12	11.5
SS OREGON MAIL	AMERICAN	18	49.0 N	178.3 E	00	23	50	5 NM	31	1011.9	12.7	6.7	6	10	20	9	10
MV ATLANTIDE	SWEDISH	21	16.2 N	99.2 W	18	25	48 (C)	1 NM	81	1002.0	25.0	30.0	8	24.5			
MV LEO	LIBERIAN	26	45.0 N	138.0 E	00	14	N 45	.5 NM	95	1002.0	15.0	16.0	5	11.5	18	7	16.5
MV EASTERN BUILDER	LIBERIAN	29	50.1 N	174.1 W	00	08	N 42	5 NM	01	1029.0	14.0	11.0	5	10	08	7	13
NORTH PACIFIC		OCT.															
SS SUMMIT	AMERICAN	1	56.6 N	155.4 W	18	32	52	10 NM	03	1010.8	6.1	11.2			32	6	19.5
SS MILLYER BROWN	AMERICAN	2	59.7 N	148.8 W	00	32	45	> 25 NM	02	997.0	6.7	11.1			32	< 6	9
SS NEWARK	AMERICAN	2	56.9 N	144.7 W	06	31	45	10 NM	02	988.3	4.5	11.2	7	10	31	11	24.5
SS CHEVRON CALIFORNIA	AMERICAN	2	58.0 N	148.1 W	12	32	45	5 NM	02	997.3	4.4	8.9	6	14.5	32	6	16
SS HAWAII BEAR	AMERICAN	3	39.4 N	125.5 W	12	35	55	10 NM	02	1014.9	13.9	16.7	2	10	35	8	24.5
MV ISLAND PRINCESS	NORWEGIAN	6	15.2 N	95.3 W	18	02	43	10 NM	00	1010.2	27.8	29.0	5	10	01	9	14.5
SS PURTLAND	AMERICAN	11	57.2 N	150.1 W	18	32	45	5 NM	31	1014.9	5.6	11.7	7	11.5	03	11	19.5
USCGC PLANETREE	AMERICAN	11	58.7 N	140.8 W	18	12	N 30	1 NM	65	986.8	7.6	12.7	8	19.5	12	7	29.5
MV MAMMOTH PINE	LIBERIAN	11	52.5 N	142.5 W	12	22	N 30	2 NM	07	994.0	10.0	10.5	12	19.5			
SS PHIL MAIL	AMERICAN	11	48.1 N	158.6 E	12	27	42	10 NM	01	1007.1	10.6	9.3	5	16.5	27	6	21
SS SEALAND COMMERCE	AMERICAN	11	24.7 N	120.5 E	06	04	48 (H)	5 NM	30	1008.8	23.9	23.9	5	14.5			
MV TOYOTA MARU # 10	JAPANESE	12	47.4 N	174.3 W	06	26	N 48	2 NM		984.5	11.0	9.5			27	X	19.5
MV STELLA PRIMA	LIBERIAN	14	49.0 N	148.3 W	18	18	30	200 YD	05	992.6	12.0	10.0	XX	19.5			
SS SANTA CLARA	AMERICAN	14	49.5 N	142.8 W	18	14	30	1 NM	63	999.0	14.5	13.5	3	10	14	6	16.5
MV ZENLIN GLORY	LIBERIAN	14	34.8 N	151.4 E	00	09	N 41	200 YD	80	1010.0	22.0	26.0			09	< 6	11.5
SS GALVESTON	AMERICAN	15	57.3 N	145.7 W	06	07	45	5 NM	63	973.0	8.3	10.0	5	10	07	8	18
MV ZENLIN GLORY	LIBERIAN	15	34.7 N	155.1 E	00	05	N 41	> 25 NM	01	1010.0	25.5	25.0	5	13	05	7	19.5
SS ZIM NEW YORK	GERMAN	15	24.9 N	120.5 E	06	03	38	5 NM	02	1007.0	25.0	27.0	4	10			
SS SANTA CLARA	AMERICAN	15	49.3 N	141.5 W	00	29	50	2 NM	30	1002.4	10.2	15.0	10	24.5			
MV ASIA BRAVERY	LIBERIAN	15	48.1 N	131.5 W	00	29	N 52	5 NM	10	994.0	12.0	13.0	9	19.5			
MV EMMA JOHANNA	GERMAN	15	54.0 N	139.6 W	18	29	48	2 NM	07	996.5	10.0	11.0	10	23	29	12	42.5
MV EMMA JOHANNA	GERMAN	16	53.9 N	140.0 W	00	34	58	10 NM	07	1007.8	10.4	10.0	10	23	34	12	42.5
MV AMERICA MARU	JAPANESE	18	42.5 N	177.5 E	18	31	N 45	.5 NM	65	999.0	13.0	16.0	5	10	12	10	16.5
MV HONTIRON	LIBERIAN	20	49.9 N	165.6 E	00	27	50	5 NM	20	998.0	8.0						
MV EASTERN BUILDER	LIBERIAN	20	51.3 N	147.3 W	18	31	N 44	5 NM	02	1008.0	11.0	11.5			31	< 6	10
MV NEBULA	LIBERIAN	20	41.2 N	175.9 W	00	27	N 41	10 NM	01	999.9	13.0	14.0	7	11.5	29	>13	10.5
SS ZIM MONTREAL	LIBERIAN	20	37.3 N	178.8 E	06	27	50	10 NM	03	1010.0	19.0	20.0	7	14.5			
MV EMMA JOHANNA	GERMAN	20	52.7 W	178.5 W	12	10	41	10 NM	02	989.9	6.5	7.0	9	13			
MV PEARL VENTURE	LIBERIAN	21	49.3 N	175.8 E	06	30	N 45	5 NM	25	1003.0	7.5	8.0		19.5	30		30
SS PRES JOHNSON	AMERICAN	21	39.2 N	161.3 E	18	32	48	10 NM	02	1014.2	13.4	18.3	XX	10	32	13	13
MV CORAL ARACADIA	LIBERIAN	21	41.9 N	180.5 E	06	33	N 48	5 NM	03		11.0	14.8	9	24.5	29	10	29.5
MV NARCONAFLO MERCHANT	LIBERIAN	22	41.2 N	165.2 E	06	30	35	10 NM	02	1014.0	12.3	14.0	6	16.5			
SS PHIL MAIL	AMERICAN	22	43.4 N	175.3 W	18	23	47	5 NM	02	977.3	9.4	11.1	6	16.5	23	6	24.5
SS PRES JOHNSON	AMERICAN	22	37.6 N	171.9 E	18	30	45	10 NM	02	1016.9	15.0	21.1	XX	10	31	X	24.5
MV PLUVIUS	GERMAN	22	38.4 N	178.4 W	18	27	48	5 NM	25	1009.0	14.5	16.5	4	13	28	10	19.5
MV SPERO	NORWEGIAN	22	38.1 N	176.1 E	12	31	42	5 NM	92	1009.4	13.6	16.0			32	X	19.5
SS MICHIGAN	AMERICAN	22	27.2 N	124.4 E	12	03	45 (D)	5 NM	16	1016.5	21.1	23.4	3	8	03	7	14.5
SS EXPORT COURIER	AMERICAN	22	39.3 N	174.5 W	06	19	N 32	5 NM	02	995.3	15.6	15.5	7	16.5			
SS AMER LYNX	AMERICAN	22	22.3 N	121.2 E	12	01	50 (D)	5 NM	25	1010.0	24.0	26.0	6	24.5			
SS ZIM NEW YORK	GERMAN	22	39.5 N	171.2 E	06	30	48	2 NM	16	1007.0	12.1	10.0	11	16.5			
SS AMER LYNX	AMERICAN	23	26.0 N	124.5 E	06	03	50 (D)	5 NM	25	1015.2	22.2	25.6	6	24	03	>13	24
SS ARCO PRUDHOE BAY	AMERICAN	23	54.8 N	149.8 W	18	13	45	2 NM	61	990.0	8.5	7.8	5	19.5	15	11	10
MV LEO	LIBERIAN	23	45.4 N	137.0 W	00	17	N 45	.5 NM		989.0	14.0	15.0			17	9	29.5
MV PLUVIUS	GERMAN	23	38.0 N	175.7 W	06	27	48	2 NM	25	1007.5	11.9	17.3	10	23	29	10	32.5
SS EXPORT COURIER	AMERICAN	23	38.4 N	168.6 W	00	25	N 39	5 NM	01	1001.7	10.3	13.0	5	16.5	23	7	23
SS PHIL MAIL	AMERICAN	23	43.6 N	170.4 W	06	25	40	2 NM	18	979.3	9.4	11.1	4	16.5	25	6	24.5
SS ZIM NEW YORK	GERMAN	23	39.3 N	179.2 E	00	30	41	5 NM	03	1007.0	12.5	18.0	10	19.5			
MV EASTERN BUILDER	LIBERIAN	23	47.8 N	156.8 W	00	16	N 33	2 NM	58	987.0	12.0	11.0	4	13			
SS PRES JOHNSON	AMERICAN	23	37.4 N	177.2 E	06	29	43	10 NM	02	1017.3	14.4	18.9	XX	11.5	31	12	24.5
SS PRES POLK	AMERICAN	23	37.0 N	175.0 W	00	28	42	10 NM	18	1007.8	14.4	17.8	8	16.5	29	>13	28
MV SPERO	NORWEGIAN	23	37.8 N	179.4 W	06	30	44	10 NM	01	1013.0	14.3	15.0	17	16.5			
SS EXPORT COURIER	AMERICAN	24	37.9 N	160.3 W	00	27	N 30	10 NM	01	1009.0	17.5	18.1	7	13	27	9	32.5
MV EASTERN BUILDER	LIBERIAN	24	45.4 N	159.0 W	00	25	N 41	5 NM	03	984.5	14.0	12.8	6	16.5	29	6	19.5
MV JAPAN ACE	JAPANESE	26	37.9 N	197.1 W	00	23	N 42	2 NM	80	1006.5	19.0	16.0	6	10	24	10	19.5
SS CHEVRON TRANSPORTER	LIBERIAN	27	19.6 N	121.5 E	18	02	30 (E)	10 NM	81	996.0	26.5	27.0					
MV ASIA BRAVERY	LIBERIAN	27	53.3 N	139.3 W	06	24	N 43	5 NM	01	991.0	9.5	11.0	2	6.5	24	8	13
SS POLAR ALASKA	LIBERIAN	28	47.5 N	158.3 E	12	16	N 38	1 NM	63	978.0	8.0	9.0	3	10.5			
MV NARCONAFLO MERCHANT	LIBERIAN	28	51.8 N	145.1 W	00	29	41	10 NM	03	999.8	9.0	9.0	6	14.5			
MV SELANDIA	DANISH	28	25.7 N	121.9 E	06	05	44 (E)	2 NM	07	1009.0	22.4		7	26			
SS CHEVRON TRANSPORTER	LIBERIAN	28	19.7 N	122.0 E	06	04	38 (E)	2 NM		992.0	26.5	26.5					
SS AVILA	AMERICAN	28	53.2 N	143.7 W	18	25	45	10 NM	02	1000.8	6.7	6.7	6	19.5	25	9	24.5
MV BELWUDSON	BRITISH	28	37.5 N	134.9 E	06	18	N 30	.5 NM	65	996.4	20.6	23.0			18	6	13
SS PRESIDENT MADISON	AMERICAN	29	29.0 N	120.2 E	06	03	N 45	5 NM	02	1003.7	22.8	22.8	10	23			
SS EXXON NEWARK	AMERICAN	29	38.9 N	124.1 W	00	32	44	2 NM		1004.0	13.0	14.0	7	14.5			
SS SEALAND GALLOWAY	AMERICAN	29	25.0 N	121.8 E	00	03	30	5 NM	02	1002.1	22.7	22.2	7	10			
MV STAR BILLABONG	LIBERIAN	29	54.5 N	142.0 W	12	10	48	2 NM	92	991.0	8.0	7.0					
SS AVILA	AMERICAN	29	51.6 N	136.9 W	18	13	30	2 NM	21	990.5	10.6	10.0	7	14.5	15	10	16
SS AMER AQUARIUS	AMERICAN	29	24.9 N	120.7 E	00	05	30	2 NM		1004.1	19.5	22.7	8	19.5			
MV PEARL VENTURE	LIBERIAN	30	36.4 N	142.7 W	18	15	N 42	5 NM	15	991.0	11.5	7.0	7	24.5	16	8	32.5
SS MOBILE	AMERICAN	30	38.6 N	190.3 W	18	06	45	5 NM	60	981.0	8.3	7.8	5	13	08	6	29.5
MV STAR BILLABONG	LIBERIAN	30	54.1 N	152.5 W	18	28	42	5 NM	03	988.5	9.5	8.0					
SS AVILA	AMERICAN	30	51.4 N	136.5 W	00	18	30	2 NM	21	990.9	12.8	10.0	7	19.5	28	X	29.5
MV PEARL VENTURE	LIBERIAN	31	59.9 N	141.2 W	00	14	N 41	.5 NM	62	986.0	11.5	8.0	7	28	18	7	19.5

\+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

(P) Typhoon Polly
(V) Typhoon Virginia
(C) Hurricane Orlene
(B) Typhoon Bess
(D) Typhoon Della
(E) Typhoon Elsie

NOTE: The observations are selected from those with winds ≥ 35 kt or waves ≥ 25 ft from May through August (≥ 41 kt or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest wind speed was selected.

(Continued from page 107.)

Sea, on the 24th and 25th, Elaine was developing and making her way toward her Luzon rendezvous. Elaine was first detected near 18°N, 140°E. She traveled west-southwestward then westward. On the 26th, Elaine became a typhoon. She intensified rapidly, and the following day 100-kt winds were roaring around her center, which was closing in on Luzon. Elaine crossed the Island, late on the 27th and early on the 28th. Winds were estimated at 90 kt near her center. Over on the west side of the Island, winds of 50 kt were reported on a 6-hourly observation at Vigan. Although she was punished for her overland journey, Elaine was able to sustain typhoon strength. She swung northwestward through the South China Sea on a path reminiscent of Carmen's. The Korean 3,805-ton MOKPO encountered heavy weather at 21.9°N, 122.6°E, on the 29th, and reported flooding and serious damage. She proceeded assisted by the No. 27 DONGHO. As the month came to a close, as if on signal, Elaine suddenly slowed and fizzled shortly before reaching mainland China.

Casualties -- On the 10th, a tug attempting to reach the 14,488-ton American tanker TROJAN, which was reported holed, failed due to typhoon Bess. The Liberian tanker GOLAR SABANG (9,228 tons) reported heavy weather damage when she arrived at Singapore on the 12th. The 9,055-ton Somali motorship DIAMOND EAGLE went aground at San Fernando, Luzon, during typhoon Bess. The Greek motortanker DEFENDER COLOCOTRONIS (8,821 tons) also reported heavy weather damage on reaching Bombay Harbor.

Rough Log, North Atlantic Weather

December 1974 and January 1975

ROUGH LOG, DECEMBER 1974 -- There was an above-average number of cyclones this month across the North Atlantic. The overall pattern was as usual, from the North American east coast south of Labrador toward the Norwegian Sea. The primary tracks out of the central and eastern United States were farther south than normal. As these tracks moved off the coast, they had a more easterly than northeasterly component, as is usual. This took the storm paths farther eastward than the climatological tracks indicate, and therefore, more storms passed east of Iceland than the climatic mean would indicate. Two centers traversed the northern Mediterranean Sea. The United Kingdom and central Europe were relatively free of storm centers, but not their effects. The storm track across Hudson Bay was easterly rather than northeasterly into Baffin Bay.

The pressure pattern reflected the more easterly track of the storm centers. The Icelandic Low was centered over the Norwegian Sea at 987 mb, near 68°N, 02°E. The climatological center is 1000.7 mb near 62°N, 38°W. A subcenter at about 993 mb was located near that position.

A sharp trough stretched from the Norwegian Sea Low to south of Iceland, to St. Johns, Newfoundland, and then paralleled the east coast of the United States about 500 mi to sea.

The Azores High (1031 mb) was centered over Spain rather than its normal location of 35°N, 33°W, at 1021.1 mb.

The anomalies were large and centered near the pressure centers. A negative 18-mb was centered off Norway near 66°N, 03°E. A positive 14-mb center was near Bilbao, Spain, and another positive 13-mb center was located over Hudson Strait.

The misplaced surface centers were reflected in the upper-air pattern. At 700 mb, the primary low center was located near its normal position over Ellesmere Island, but about 100 ft lower than normal. Another center was over the Norwegian Sea, reflecting the surface center there. A closed High was positioned off Portugal, resulting in a 400-ft anomaly over the surface high. The Norwegian Low and the Spanish High resulted in a very tight pressure gradient across northern Europe.

Extratropical Cyclones -- This system formed off the Gulf Coast in an inverted trough associated with a weak front. A large double-celled east-west oriented HIGH was located north of the Great Lakes. The HIGH remained quasi-stationary while the LOW moved northward (fig. 32). The tight gradient produced easterly

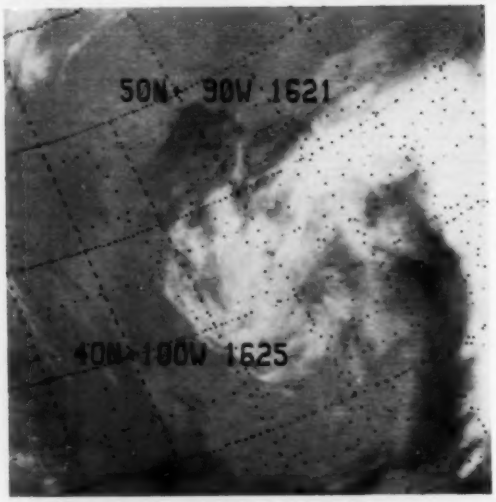

Figure 32. -- Dense clouds still cover Lake Michigan and indicate the severity of the storm that sank the JENNIFER. The lower clouds are the gray areas surrounding the white area.

winds gusting to 40 kn and waves of 8 to 10 ft. The 210-ft Canadian cargo ship JENNIFER, about 20 mi northeast of Milwaukee, sank, on the 1st, when her cargo shifted. All aboard were rescued. See a more detailed account on page 95. There was considerable flooding and beach erosion on southern Lake Michigan and the southwestern shore of Lake Erie. At the same time, gale-force winds were blowing off the Carolinas and in the Gulf of Campeche. EB-13 reported 31-ft seas with 40-kn southeasterly winds. On the west side of the front, which was off the Georgia coast with a small frontal wave, the REIYO MARU had only 30-kn winds from the west with 16-ft seas, but the swell was 26 ft from the southeast. The COSMOS FOMALHAUT was north of the Yucatan Peninsula, near 22.5°N, 88.5°W, and sailing into 55-kn northwesterlies with waves to 25 ft. Gusts reached 52 kn at Washington National Airport, and were reported as high as 60 kn in New York. On the 1st or 2d, the 3,714-ton Panamanian MARTHA S. radioed she was taking water in mountainous seas about 350 mi northeast of Miami, and her pumps could not handle it. She later reported her pumps were repaired and proceeded to Philadelphia.

As the LOW's center moved up the East Coast, it deposited heavy snows in the Appalachian Mountains. In western Maryland, roads were blocked and power outages occurred as 30 in fell. On the coast, Delaware and Maryland beaches and resorts took a beating, and damage ran into the millions of dollars. The 27,977-ton Liberian ore carrier OSWEGO LIBERTY collided with the 30,724-ton Liberian bulk carrier STRUMA, in Annapolis anchorage, and was beached.

On the 2d, OWS Hotel reported 50-kn winds. By 0000 on the 3d, several centers developed off the northeast coast. The EXPORT AIDE was south of one of these temporary centers, near 36°N, 67°W, battling 65-kn winds. Twelve hours later, she was still fighting 60-kn winds slightly farther to the northwest. The seas were 15 ft and the swells 30 ft.

The 974-mb LOW moved over the Gulf of St. Lawrence on the 4th (fig. 33). At 1200, the ANTON DOHRN had 50-kn winds and 26-ft seas off Cartwright. Late on the 4th, the system split into two centers, one continuing northeastward, and the other turning southeastward. The ANTON DOHRN now had 60-kn winds and 39-ft seas, near the same location, with -2°C air temperature.

Late on the 5th, the main LOW was south of Kap Farvel and, by the 6th, had consolidated with a stationary LOW south of the Denmark Strait. The other center curved eastward, on the 5th, then northeastward on the 6th to die out on the 7th.

On the 12th, two large HIGHs dominated the North Atlantic south of Newfoundland and south of Iceland. On the 13th, a small LOW developed off Portsmouth as a cold front moved off the U. S. east coast. The LOW moved northeastward with little development until the 14th, when it was over the Labrador Sea. By midday of the 15th, it was 990 mb as it passed south of a LOW stalled between Greenland and Iceland. On the 16th, it absorbed that circulation, and the winds picked up. A station on eastern Iceland reported 45-kn winds, as did the HVASSAFELL, just off the coast. At 1200, the SONETTE was near 58.5°N, 29°W, struggling with 55-kn westerly winds and 16-ft seas. The next day, the SMIT LLOYD 14 found 45-kn gales over the North Sea.

On the 18th, the LOW crashed against the coast of Norway. An island or coastal station of the Netherlands reported 45-kn northwesterly gales. Later that day, the LOW jumped the mountains to near Helsinki and the Gulf of Finland.

The forerunner of this storm started over northern Florida on the 16th. It was a beachcomber as it moved up the coastline to the Gulf of St. Lawrence by the 19th. On the 18th, several waves formed on the front, off the coast, but did not persist. On the 19th, a new closed circulation developed, near 45°N, 50°W, at the occlusion.

It rapidly became the predominant LOW as it moved northeastward. VC 8062 reported 50-kn gales. At 1200, the ASIA FREIGHTER was near 42°N, 57°W with 50-kn winds. Gales were blowing all around the storm. At 0000 on the 20th, the DART ATLANTIC, at 47°N, 42°W, also found the 50-kn isotach. The wind and seas of 21 ft were from the west, and the 30-ft swells from 250°. Twelve hours later (fig. 34), she battled 50-

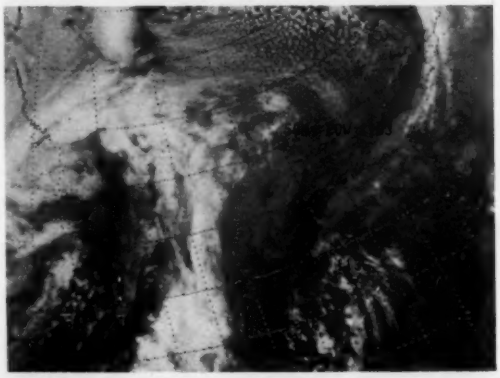

Figure 33.--The cold-high clouds hide the vicious 60-kn winds and 39-ft seas on the ocean's surface.

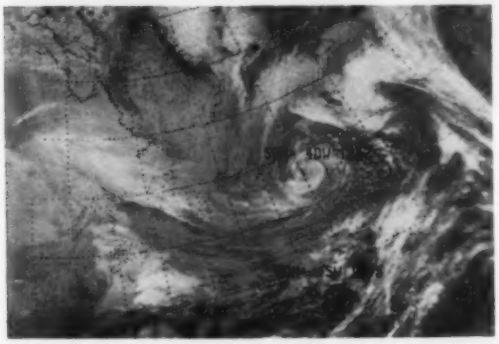

Figure 34.--At 1242, the center of the storm is clearly defined near 48°N, 40°W, by the NOAA-4 satellite.

kn winds, 23-ft seas, and 30-ft swells. About 100 mi south, the DART AMERICA was fighting 55-kn winds, but the highest waves were only 25 ft, and she was moving with them. Still farther south, near 42°N, 43°W, the NEW ENGLAND SCOUT reported 50-kn winds and 26-ft seas.

Through the 21st, the LOW moved almost due east, but on the 22d turned northeastward. The wind reports were not as strong, but weather ship JULIETT was hit by 45-kn gales as the center passed about 60 mi to the north. This was its last breath as it expired by the next day.

The pressure gradient was flat over the eastern United States and off the East Coast, on the 21st. On the 22d, it started to organize, and a LOW formed off Cape May. As it moved northeastward and over the Gulf Stream, it deepened, dropping 15 mb in 24 hr.

By 1200 on the 23d, the 985-mb center was at 42.5°N, 44.5°W. At that time, the ATLANTIC COGNAC, near 40°N, 60°W, was sailing into 50-kn winds and 33-ft seas. The CHEVRON LIEGE, NEDER EBRO, and SUSSY all reported 45-kn gales. At 1200 on the 24th, the FRANKFURT was being swept by 60-kn winds and 30-ft swells at 41.2°N, 41.3°W. The MUENCHEN, about 80 mi to the north, suffered 50-kn winds and smaller seas (fig. 35).

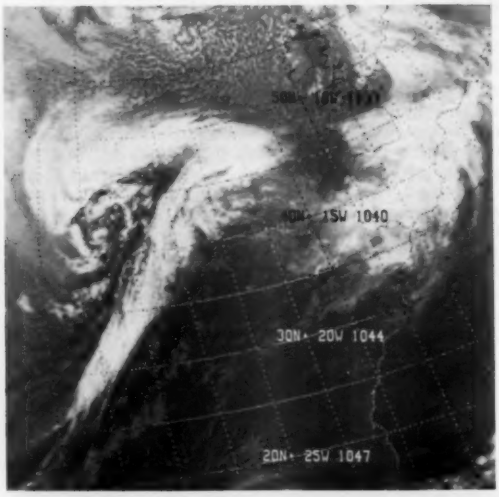

Figure 35.--It was no quiet Christmas Eve for the ships on the central Atlantic, as the winds howled and the seas pounded.

On Christmas Day, the AVON FOREST was near 47°N, 25°W with 45-kn gales. Although there were no extreme winds, most ships between 35°W and the coast, and 40° to 55°N, had gale-force winds. On the 26th, the LOW started to weaken and curve northwestward toward Greenland, where it dissipated.

The weather forecaster and analyst working shift on Chirstmas Eve found this storm. It was over southern Indiana at 0000 on the 25th. Its upper-air support was in a strong wind band of the zonal flow. The LOW raced eastward and, by 0000 on the 26th, was near 40°N, 62°W, and 986 mb. Twelve hours later, the central pressure had dropped to 964 mb. Three ships reported 50-kn winds in the southern half of the circulation. They were the CHEVRON LIEGE, DJIBA, and MIECZYSLAW KALINOWSK. Forty- and 45-kn winds were common as far as 500 mi south of the center, and to the East Coast.

At 0000 on the 27th, the 960-mb center was at 48°N, 42°W. Off Notre Dame Bay the APATIT battled 55-kn winds. VC 8062 measured 50-kn winds, and the pressure had risen 16.8 mb during the past 3 hr. East of the occlusion, near 46°N, 33°W, the NOVODRUZHESK also had 50-kn winds and 23-ft seas.

During the next 24 hr, the storm moved northeastward with little change in pressure, but the maximum winds reported were 45 kn. Ocean Weather Station "J" was one of these and was also tossed by 30-ft seas and 15-ft swells. The seas were from the west-southwest, and the swells from the south. On the 28th, the storm joined another LOW near Iceland.

This LOW formed over the Gulf of St. Lawrence, on the 30th, in conjunction with a frontal system out of another LOW over Ungava Bay. It moved over the Strait of Belle Isle, and SEDCO I had 45-kn gales at 0000 on the 31st. Twelve hours later, it was 982 mb near 57°N, 46°W, with gale winds on both sides of the front. The LOW center passed over Kap Farvel as it raced toward the Denmark Strait on January 1. At 0000 on the 2d, the ERNST KRENKEL, about 120 mi south of Kap Farvel, struggled with 55-kn winds at -4°C. She reported 5 cm of ice from spray building slowly. The pressure of the LOW had dropped to 949 mb. Later that day, 40- to 45-kn winds were no oddity from south of Iceland to Scotland, and to northern Norway. Höfn, Iceland, measured 50 kn, as did Ocean Weather Station "M," along with 28-ft seas. On the 3d, it was absorbed by a semipermanent LOW over the Norwegian Sea.

The final transit through the St. Lambert Lock of the Great Lakes-St. Lawrence Seaway for the season was made by the Greek freighter GEORGIOS A., on the 17th. This same ship was in a collision with the Laker H. LEE WHITE in the St. Clair River on the 11th.

Casualties--The British motorvessel BENGATE arrived Bermuda, on the 7th, with cargo shifted by heavy weather. The 21,530-ton American OVERSEAS ALEUTIAN broke mooring lines while discharging at Donges, France, on the 9th. The vessel drifted aground and was refloated with the aid of tugs.

ROUGH LOG, JANUARY 1975--The extratropical cyclone centers that traversed the North Atlantic were much more numerous than the climatological normal. They were also shifted further to the east, especially as they entered the Norwegian Sea. The tracks into the Great Lakes were normal, but the primary climatological track along the St. Lawrence River was missing. The path from about 45°N, 45°W, toward 62°N, 10°W, was well traveled.

The shift in the storm tracks was reflected in the monthly mean pressure pattern. The Icelandic Low

was shifted eastward with two centers, a 988-mb near 62°N, 18°W, and a 989-mb near 67°N, 02°E, rather than a single 997-mb center near Kap Farvel. The orientation was near normal. The 1022.7-mb Azores High was shifted, with two centers, one 1026-mb over Spain and a 1027-mb over Algeria. The pressure over the U.S. east coast was slightly above normal with a 1017-mb bubble High over New Brunswick.

The largest anomaly was negative with two minus 15-mb centers associated with the Icelandic Lows. There were two positive 7-mb centers, one over Algeria and the other over Labrador.

The primary low-pressure center for the Northern Hemisphere, at 700 mb, was near Somerset Island (72°N, 90°W). Surprisingly, the 700-mb center over the Aleutian Low was a minor one; three others were deeper. A closed high-pressure center was located east of Miami and north of San Juan. A general statement on the anomaly pattern would indicate negative north of 48°N, and positive south of that latitude to about 15°N.

Extratropical Cyclones--The Atlantic and its northern seas were a very rough body of water this month. The storms were numerous and severe. One of the lower pressure values for an extratropical cyclone occurred, at 0000 on the 3d, near Bjørnøya (fig. 36). A pressure of 937 mb was analyzed; this is equivalent to about 2,150 ft above standard sea level.

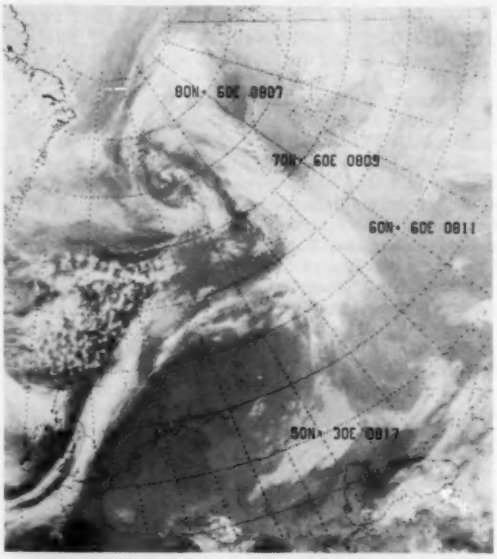

Figure 36.--There were only two tropical cyclones, during the 1974 season in the North Atlantic and eastern North Pacific, that had lower central pressures than this 937-mb extratropical LOW.

A 1014-mb LOW formed over Ohio on New Year's Eve. By 1200 on New Year's Day, it was 1004 mb, south of Cape Cod. Twenty-four hours later, it was 976 mb off Nova Scotia, and the PHOTINIA was sailing with 55-kn winds about 300 mi east of Cape May. Fifty barrels of tetraethyl lead were washed off the deck of the container ship MORMACVEGA, about 190 mi southeast of New York. At 0000 on the 3d, the 979-mb LOW was near St. Mary's Bay. Behind the front and slightly ahead of a secondary trough, the LYMAN HALL (34°N, 66°W) encountered 45-kn gales with 36-ft seas from 340° and 39-ft swells from 310°. She was surely taking a beating, even though they were on the stern. The CAPE FREELS reported 50-kn winds south of Sable Island. At 1200, the AUSTRAL PILOT, near 35°N, 61°W, braved 50-kn winds, 20-ft seas, and 30-ft swells. Further along the windflow, the GNJO (32°N, 58.6°W) coded only 35-kn gales, but 30-ft seas, and 36-ft swells. By 0000 on the 4th, the main LOW broke into several centers.

A frontal wave developed, near 36°N, 66°W, at 1200 on the 5th. It deepened very rapidly and was 998 mb, near 39°N, 58°W, at 0000 on the 6th. The TOM JACOB was fighting 60-kn winds on her portside as she sailed eastward. The LOW was moving north-northeastward with little change in pressure. At 1200 on the 7th, the 995-mb LOW was about 600 mi south of Kap Farvel. The QUEEN ELIZABETH 2 was near 47°N, 46°W, and being pounded by 55-kn winds of 2°C, while the 20-ft seas and 43-ft swells hammered her starboard side. It is doubtful if any passengers were lounging on the deck. The TOM JACOB continued to have a rough voyage, with 40- to 50-kn winds and 15- to 20-ft waves.

The storm continued toward the northeast, on the 8th and 9th, with gale-force winds and moderate seas. A Polish trawler capsized off a pier at Hansholm, Denmark. Ten crewmembers died, and 17 were rescued by Danish army helicopters. On the 10th, the storm crossed the Scandinavian Peninsula and out of the area of concern.

This storm ran the gauntlet from Florida to the Norwegian Sea. It entered the arena, at 1200 on the 6th, off Jacksonville, weighing 1019 mb. It moved up the East Coast, and, by 1200 on the 8th, it was near Sable Island. Gales were reported south and east of the center. At 1200 on the 9th, the drilling ship VC 8062, near 45.5°N, 55°W, piped in 50-kn winds with 25-ft swells. The track had now turned eastward, with a slight southerly component.

The storm overtook and passed the AMERICAN ACE, which was lashed by 55-kn winds, and waves to 20 ft, near 46°N, 41°W. The LEVERKUSEN, near 41.5°N, 46°W, was faring no better with 50-kn winds and 23-ft swells. Nearby, a ship reported 33-ft swells. On the 10th, the storm again turned northeastward, with only gale-force winds plotted. The 10,150-ton AFRAN ZODIAC was holed by the tug BANTRY BAY, and spilled 113,000 gallons of her fuel into Bantry Bay.

At 1200 on the 12th, the 960-mb LOW was near 60°N, 16°W (fig. 37). A ship at 60°N, 11°W radioed a howling 60-kn wind from the south-southwest as it headed westward. Twelve hours later, the WEATHER REPORTER measured 50-kn winds in the vicinity of 57°N, 13°W. She was taking a beating from 39-ft seas. At 1200 on the 13th, the seas were 20 ft, and the swells 36 ft. The LOW's center passed near the Faeroe Islands, late on the 13th, and was absorbed by a following LOW on the 14th.

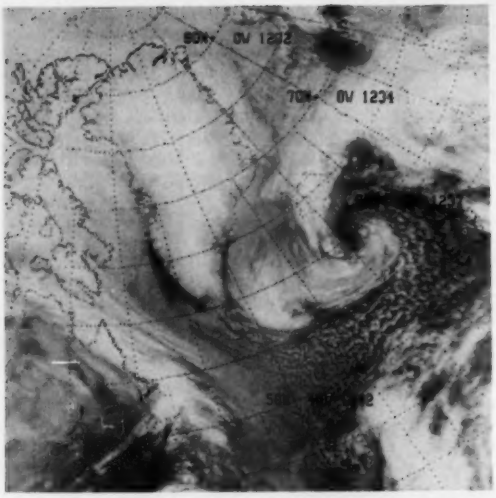

Figure 37.--This satellite cloud picture verifies the surface analysis, but without the ship reports the strength of the storm would be difficult to assess.

A 1020-mb frontal wave was analyzed off Cape Hatteras, on the 17th. It raced northeastward and, at 0000 on the 18th, was near 44°N, 48°W, with gales up to 600 mi south of the center. Twelve hours later at 1200, the CAROLA REITH was ravaged by 60-kn westerly winds and 30-ft swells, near 46°N, 41°W. Winds of 35 to 45 kn occurred around the storm's circulation for the next 48 hr. At 1200 on the 19th (fig. 38), Ocean Weather Station "J" reported 39-ft seas; 12 hr later, 33-ft seas and 28-ft swells with 40° difference in direction. Coastal stations of England and Ireland were reporting gales.

At 1200 on the 20th, the 972-mb storm was at 60.5°N, 10°W, and the LEVERKUSEN, at 55°N, 18°W, was plowing into a 65-kn foaming sea and 23-ft seas. Ocean Weather Station "I" measured 45-kn winds, 15-ft seas, and 20-ft swells, while her sister, "J," suffered 35-kn winds, 23-ft seas, and 15-ft swells. Late on the 20th, the LOW center moved over the Faeroe Islands and perished near Nordkopp, on the 23d.

Monster of the Month -- This is an account of a storm system, rather than the history of a single LOW, as several are involved over the storm's life cycle.

The initial circulation has its beginning west of the Queen Charlotte Islands in the Pacific, late on the 16th. The LOW crossed the Great Lakes on the 18th and 19th. By 0000 on the 19th, gale-force winds were blowing off the New England Coast. At 1200, the CETRA COLUMBA, near 41°N, 58°W, reported 65-kn winds with a violent rainshower, at the cold front.

At this time, a new LOW formed south of Sept-Iles, over the St. Lawrence. Forty-knot winds were blowing north and east of Newfoundland. The MONT LOUIS was near 50.5°N, 46°W, with 50-kn winds. The two LOWs were moving northward to rejoin their circulations, on the 21st, in the Davis Strait. At 1200 on the 20th, the MANCHESTER CONCORDE (47.5°N, 44°W) reported 45-kn winds, 15-ft seas, and 23-ft swells. The C.P. VOYAGEUR radioed 45-kn winds with 20-ft swells, at 1200 on the 21st.

Late that day, another center developed near 59°N, 31°W, as yet another center materialized and quickly decayed near Kap Farvel. The pressure gradient from the Labrador Sea, across the latitude band of 45° to 60°N, and the Bay of Biscay to Iceland, could have supported a windspeed of near 100 kn, but 45 kn was the highest reported, by OWS JULIETT, along with 26-ft seas and 18-ft swells.

By 1200 on the 22d (fig. 39), the windspeeds were catching up to the gradient. The LOW's 952-mb cen-

Figure 38.--Several centers of circulation can be observed. The one of concern was near 54°N, 19°W; others are near 58°N, 34°W, 44°N, 33°W, and Newfoundland.

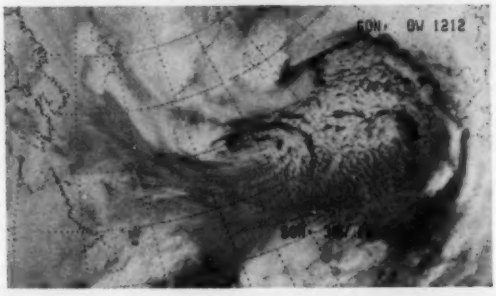

Figure 39.--The center and configuration of this strong storm are not nearly as apparent as those of others much weaker.

ter was just south of Vik, Iceland. The SUGAR CRYSTAL was near 57°N, 23°W, with 65-kn howling winds, 49-ft seas, and 57-ft swells. Ocean Weather Station "J" was managing to stay afloat with the same 65-kn winds and 49-ft seas, but piddling swells of only 28 ft. INDIA, to the north, survived 45-kn winds, with 26-ft seas and 30-ft swells. The LENIE, near 64°N, 12°W, reported only 60-kn easterly winds, as did a land station on the east coast of Iceland. The ATLANTIC CAUSEWAY, just north of Donegal Bay, was sailing into 50-kn winds driving slight showers of hail, 16-ft seas, and 25-ft swells.

Twelve hours later, at 0000 on the 23d, the winds at INDIA and JULIETT were 45 and 35 kn, respectively, but the seas were still very high: INDIA - 30-ft seas and 45-ft swells; JULIETT - 39-ft seas.

Twelve hundred on the 23d produced another report of 60-kn winds, this time by the HENNINGSDORF, near 57°N, 20°W, with no comment on the sea condition. The SUGAR CRYSTAL, near 55.5°N, 23°W, reported 33-ft seas and 52-ft swells. INDIA was still battling 43-ft confused swells. The seas at JULIETT had decreased to 30 ft. The ATLANTIC CAUSEWAY had made little headway into 55-kn winds, with the seas and swells up to 26 ft. The 11,955-ton Swedish ATLANTIC SPAN lost one 40-ft and two 20-ft containers, at 1140 on the 23d, while near and approaching the British Isles.

On the 24th, the LOW moved across the North Sea into Norway and then on to Finland, where it only produced rain and snow.

A large LOW was moving across the northern states and was over the Great Lakes early on the 26th. Its effect was felt by the EXXON WASHINGTON, at 0000, with 50-kn winds off Wilmington, N. C. A few hours later, the LOW developed two centers; the easterly one off the coast of Maine became the center of attention. At 1200, VC 8062 was whipped by 70-kn winds while off Cape Breton Island. The pressure had plunged 9.5 mb in 3 hr. The 974-mb storm was moving up the Strait of Belle Isle and, at 0000 on the 27th, gave 60-kn winds to the ATLANTIC CONVEYOR near Cape Race. Gale reports continued as the storm moved eastward and dissipated, early on the 29th.

A large part of the reason for the demise of the storm above was this LOW, which formed in the trough of the one above, late on the 27th. It moved eastward and, at 1200 on the 28th, was 1000 mb near 41°N, 45°W. The HOECHST was near 37°N, 50°W, with 60-kn winds, but mild seas. On the 29th, the storm turned northeastward and intensified. There were no extremely strong winds reported, but 40- to 45-kn gales were widespread.

The 0000 report of the OWS JULIETT on the 30th (fig. 40) indicated the severity of the storm with a 60-kn wind. There were several subcenters by this time, which widened the circulation. The KAPITAN NOCHRIN, off the Labrador Coast, felt 55-kn winds. At 1200, the FRUBEL AMERICA, near 47.6°N, 32.4°W, also found the 60-kn isotach, while the SDZA, near 54°N, 15°W, delineated the 50-kn boundary. The storm moved into the Norwegian Sea, on the 31st, and dissipated near Jan Mayen Island.

Figure 40.--The satellite picture indicates that OWS JULIETT had clear to partly cloudy skies just prior to the 60-kn wind report.

This storm came racing out of the Midwest and should have been arrested for speeding on the New York State Thruway, as it was doing close to 50 kn as it sped across the state, on the 29th. At 1200 on the 30th, it was 972 mb near 44°N, 56°W. The VC 8062 was again lashed by 60-kn northerly winds and four-star snow. To the south, the GEORGE M. KELLER had roaring 65-kn winds and 25-ft seas and swells from the west, near 40°N, 62°W. The DAWSON, further south yet, near 37°N, 63°W, also had 65-kn howling winds, and a thunderstorm to complete the picture.

On the last day of the month, this 954-mb storm dominated the Atlantic from around 35°N to Iceland, and high winds were reported from Nova Scotia to Lands End. The following ships reported 50-kn winds: the AMERICAN ARCHER (43°N, 39°W) and 30-ft seas, the DOLLY TURMAN (40.5°N, 40°W) and 23-ft swells, and the CYWM (46°N, 58°W). The MANCHESTER VIGOUR (42°N, 32°W) reported 45 kn, with 16-ft seas and 26-ft swells, on February 1. The TRADER (42°N, 36°W) had only 30-kn gales, but the swells were 41 ft as the trough passed. Kap Farvel suffered 60-kn, -5°C, northeasterly winds compounded by three-star snow. On the 2d, the LOW stalled near Kap Farvel and dissipated, on the 3d.

Casualties--The Liberian-registered ANDROS HILLS (21,417 tons) arrived Halifax from Antwerp, on the 6th, with weather damage. The American-registered AMERICAN ORIOLE (7,929 tons) broke loose from moorings at New Orleans, during a windstorm on the 10th, and collided with four other vessels. The 1,093-ton British freighter LOVAT (fig. 41) sank 25 mi off Lands End, when her cargo of coal shifted during high winds and seas. Eleven of 13 crewmen died after their liferaft capsized in 20-ft waves. Six were rescued by a helicopter, but four of them were dead on arrival at a hospital. The 11,249-ton Italian freighter MARIA S. had to be towed to Stavanger after losing her propeller in heavy seas off the Norwegian coast.

Figure 41.--This recent photograph of the LOVAT shows her in rough seas, but they must have been rougher still when her cargo shifted, and she sank off Lands End. Wide World Photo.

Rough Log, North Pacific Weather

December 1974 and January 1975

ROUGH LOG, DECEMBER 1974--The major difference in the storm tracks this month from climatology was a major path from southern Japan eastward to midocean and then northeastward into the Gulf of Alaska. According to climatology storms forming south of Japan would move northeastward toward the Near Islands. Other tracks are across La Perouse Strait toward the western Bering Sea, from the Near Islands toward the Pribilof Islands, and from the central Aleutians and the midocean into the Gulf of Alaska. There are also secondary tracks from the Gulf of Alaska and midocean toward Vancouver Island, then inland. These tracks were generally followed except in the instance above.

The monthly mean sea-level pressure pattern was near normal in configuration. The significant difference from the climatological mean was a shift of about 20° longitude toward the east, and more intense pressure centers. The 1001.3-mb Aleutian Low (53°N, 162°E) was located near 52°N, 178°W, at 992 mb, with a 993-mb subcenter near 57°N, 148°W. The Pacific High, normally 1021.9 mb at 32°N, 145°W, was 1027 mb at 33°N, 135°W. The 1021.5-mb High center normally over the Northwestern Great Basin was 1025 mb near Salt Lake.

There were five areas of large anomalies that were directly associated with the weather of the North Pacific. Two were negative and colocated with the low-pressure centers, a 16-mb in the Gulf of Alaska and 11 mb with the Aleutian Low near 50°N, 176°W. Three were positive, a 6-mb center near 34°N, 133°W, and a 4-mb center near Salt Lake. The third was a large

area of multiple centers averaging plus 14 mb over east-central Asia and Siberia.

The upper-air pattern at 700 mb was near straight west to east flow across the broad ocean expanse. There were slight troughing tendencies near both coasts and in the central ocean. The height gradient was more intense than normal as were the height centers. The height of the pressure surface averaged about 180 ft higher than normal across the central ocean and about 350 ft lower at a center south of Adak Island.

There were two tropical storms this month, Judy and Kit, for a total of 33 named tropical cyclones for the year. This compares with an average of 25.6 for the period 1945-73. In only four other years has this number been equalled or exceeded: 1964-40; 1965-34; 1967-35; and 1971-35.

Extratropical Cyclones -- This LOW was noted for coastal winds rather than those reported by ships. If the winds were measured on the coast they probably also occurred at sea, but were not reported or observed. It formed as a frontal wave, on the 2d, and rapidly moved toward the coast. The ESSO NEWARK reported 35-kn gales near Cape Mendocino early on the 3d. Later in the day, the ESSO NEWARK, HAWAIIAN LEGISLATOR, and UTAH STANDARD reported gales. By 0000 on the 4th, the winds had gusted to 48 kn at Pillar Point, Calif., and the HAWAII had 40-kn gales off the Washington coast. Twelve hours later, as the cold front moved onto the coast, gusts to 60 kn occurred. The cold front deposited 5 to 8 in of rain in the mountains of southern California. The LOW disappeared against the Coast Mountains.

The weather pattern across the North Pacific had been diffuse for several days, both at the surface and aloft. On the 1200 surface chart of the 7th, there were three LOWs along approximately 50°N. A trough had formed south of the western two LOWs and a small center developed in the trough. It developed rapidly, moving between the two LOWs as the westernmost one, over the Kurils, remained stationary, and the other moved eastward along the Aleutians.

At 0000 on the 8th, the 982-mb LOW was at 43°N, 169°E. The KENJYU MARU was northeast of the center with 40-kn gales. At 1200, the KASUGAI MARU at 41.6°N, 159.8°E was pounded by 45-kn gales. By 0000 on the 9th, the circulation had consolidated into two centers, the other being over the Gulf of Alaska. The SHINKO MARU was tossed by 40-kn gales about 300 mi southwest of the center, while the HANETIA was battling 55-kn storm winds 900 mi away in the southwest quadrant. On the 10th, gale-force winds were reported as far as 1,200 mi south of the center. By 1200 that day, the storm was near 52.5°N, 172°W, at 967 mb. Its circulation dominated the ocean from shore to shore as far south as 30°N. At 0000 on the 11th (fig. 42), a ship hit 60-kn winds at 48°N, 141°W. As the storm entered Bristol Bay, it lost its forward motion and was filling rapidly. By late on the 13th, it had disappeared.

This storm must have set some kind of record in its race across the Pacific. It also helped contribute to the demise of the last storm. It formed near Tokyo on the 10th. By 0000 on the 12th, it was only 995 mb,

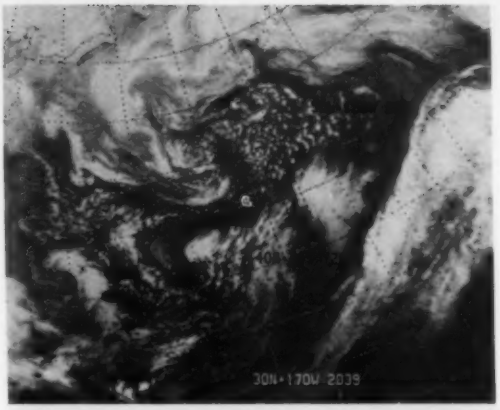

Figure 42. -- The broad circulation of this storm can be discerned in the cloud pattern. The frontal system has moved far ahead of the center.

but was already in midocean near 37°N, 177°E. It passed south of the OCTAVIA, treating her to 50-kn winds, north of the RHINE MARU with 45 kn, and gave the AMERICAN LIBERTY the same gift a few hours before passing her. The LIBERTY was really tossed about as she had 16-ft seas from the southwest, 13-ft swells from 210°, and a 7-ft swell from 320°.

It was not until the LOW reached the Gulf of Alaska that it deepened significantly. At 0000 on the 14th, it was 970 mb. At that time the PHILADELPHIA (54°N, 135°W) and the WASHINGTON MAIL (53°N, 141°W) both suffered 50-kn winds with waves as high as 25 ft. The QUADRA (49°N, 137°W) and the USCGC RUSH, near Sitka, braced 45-kn winds.

This energy only lasted a few hours as the storm beat against the mountains.

An inverted wave deepened over Korea and a LOW formed over the Sea of Japan on the 13th. The LOW developed rapidly as it moved across Japan. At 1200 on the 14th, it was 985 mb with 40-kn gales both to the south and east of the center. At 0000 on the 15th, it was near 39°N, 154°E, and 976 mb. The surface LOW developed, as an upper-air wave moved out of Asia. By the 15th, an upper-air LOW had formed at 700 mb. The SHUKO MARU, which was in the warm sector of the occlusion near 37°N, 167°E, was battered by 55-kn southwesterlies. The sea and swell were both 16 ft. Off the coast of Hokkaido, at 41°N, 147°E, the JAPAN MAIL had 50-kn starboard winds with 33-ft swells.

By 0000 on the 16th, the cyclonic circulation around the 962-mb LOW was over 1,800 mi in diameter. The fastest wind reported was 55 kn by the EASTERN BUILDER, near 40.5°N, 159°E. Five other ships battled 50-kn winds. They were the ALASKA MARU (16-ft seas, 26-ft swells), OSTROGOZHSK (33-ft seas), PACIFIC BEAR (13-ft seas, 20-ft swells), and PHILIPPINE MAIL (12-ft seas, 23-ft swells), all in the southern quadrants. The other ship was north of the center with 13-ft seas and 26-ft swells.

The center of the LOW was moving eastward about

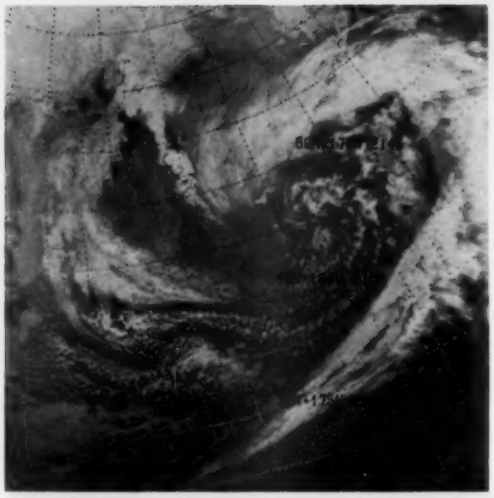

Figure 43.--There is an indication of the beginning of a new cyclonic circulation near 40°N, 158°E, at this time.

200 mi south of the Aleutians. At 0000 on the 17th (fig. 43), the VAN FORT was about 450 mi south of the center sailing into 60-kn winds with swells of 44 ft. At 1200 on the 17th, the first indication of weakening and breaking up occurred, near 38°N, 170°E, with the formation of a small LOW. Twelve hours later, the small LOW could not be analyzed with the data available, but its influence or residual influence was felt by the MARITIME DOMINION when she was ravaged by 70-kn hurricane-force winds near 34°N, 174°E. The seas and swells were both 25 ft. On later charts, the maverick LOW was reflected as a sharp trough.

On the 18th, the main LOW combined with a semipermanent LOW in the Gulf of Alaska. The gradient had relaxed and only minimal gales were reported. The LOW wandered westward and rapidly filled on the 19th.

A LOW formed near Shanghai late on the 16th, but only survived about 36 hr. At 0000 on the 18th, the chart indicated three weak LOWs straddling Japan. By 1200, only the LOW over the Kuroshio Current remained. It deepened rapidly, and a ship reported 55-kn winds near the center. At 1200 on the 19th, the 970-mb LOW was at 44°N, 160°E. A ship 200 mi north of the center had heavy snow with easterly winds. Ships east and southwest of the center reported 40- to 45-kn winds. The PAPYRUS MARU, about 360 mi east of the center, had 23-ft swells from the east. At 0000 on the 20th, the PORT LOUIS MARU and the KASUGAI MARU fought 50-kn gales, with the latter reporting 30-ft swells. The PAPYRUS had lighter winds, but the seas were still 20 ft and the swells 25 ft.

Forty- to 50-kn winds continued through the 21st as the LOW neared Amchitka Island and dominated the northern ocean. As usual when LOWs this large develop, satellite LOWs formed near the edge of the circulation and moved around the perimeter. This did not help the WAKAMIYASAN MARU, which was between the two centers with 50-kn westerly winds. The British bulk carrier PACIFIC LOGGER (10,324 tons) broke a propeller shaft near 50.7°N, 170.2°W. She was encountering high winds and 35-ft seas, and trying to get a tow from the Coast Guard vessel BALSAM, which was forced to cut the lines previously placed on board.

After crossing the Aleutian Islands the LOW slowed on its northeasterly track. One of the satellite LOWs developed rapidly, on the 23d, and moved into the Gulf of Alaska. The USCGC STORIS was at 52°N, 155°W, at 1200, and measured 60-kn winds. The seas were 10 ft and the swells 25 ft. The STORIS had to abandon towing the 6,918-ton CORINNA due to the bad weather, but was standing by the vessel (fig. 44).

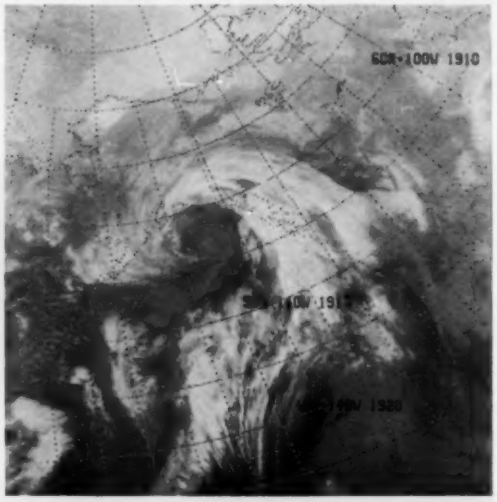

Figure 44.--The cloud pattern indicates there may have been a frontal wave south of the STORIS.

This storm was now the major concern to shipping, although the parent cyclone covered a larger area. At 0000 on the 24th, the CHEVRON HAWAII and the MOBIL OIL were both near 55°N and were battered by 60-kn howling winds. The CHEVRON HAWAII was thrashed by 20-ft seas and 41-ft swells at 142°W, while the MOBIL OIL enjoyed 12-ft seas and 34-ft swells, near 148°W. This LOW crashed into the mountains near Yakutat and disappeared over the Yukon on the 24th, while the old LOW became lost in the Alaska Mountains on the 25th.

This storm formed when the center of a LOW that had tracked out of southern Siberia split into two centers over the Kuril Islands. At 0000 on the 26th, the NANSHO MARU was hammered by 55-kn winds near 47.5°N, 155°E. The twin LOWs moved eastward, and the KEISHO MARU was in a strong wind band with 50 kn. There were seven reports of winds of 40 kn or greater within 2° of latitude 40°N from the Japanese coast to 170°E. As the eastward movement continued, the wind band spread both north and south. At 1200 on the 27th,

the ALTAJSKIE GORY was wintering at 58°N, 172°E, with 50-kn bone-chilling winds. Ostrov Beringa and Ostrov Paramushir both measured 55-kn winds.

On the 28th, this one LOW dominated the Pacific north of 35°N. The LOTUS was near 47°N, 165°E with 50-kn winds, but her greatest worry was 26-ft seas and 30-ft swells. Ostrov Simushir was frozen by 65-kn typhoon-force winds of -2°C.

The LOW was stretched along the Aleutian Islands with four centers on the 29th. Gale-force winds were common. Early on the 30th, the WORLD SUPREME was hit by 50-kn winds at 45°N, 175°E.

A wave formed near 50°N, 161°W on a front that developed out of a trough line. This storm intensified rapidly. By 1200 on the 31st, it had become the primary storm, and the old LOW had dissipated. The 954-mb center was just south of Montague Island in the Gulf of Alaska. The IDAHO STANDARD was at 54.1°N, 148.7°W, and was being tossed by 65-kn winds from the west. Near the coast, at 54°N, 136°W, the MOBILE was mauled by 50-kn winds with confused seas and 20-ft swells from both 200° and 260°. On January 1, the LOW moved ashore and was lost crossing the coastal mountains (fig. 45).

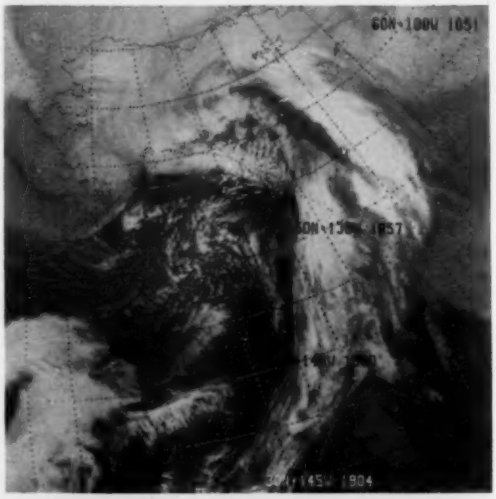

Figure 45.--It is very difficult to differentiate between the clouds and the snow cover on the mountains, as the storm approaches.

Frontogenesis was discovered over the East China Sea on the 28th. A low-pressure center materialized and moved eastward and, as it crossed the Kuroshio Current, intensified. Once under the direct influence of the zonal flow it raced across the central ocean and was of little consequence until it approached the Gulf of Alaska on the 2d. At 0000 of that day, the central pressure was 970 mb. The JAPAN BEAR and YAKU MOKAWA MARU were both in the vicinity of 44°N, 152°W with 55-kn winds. The former reported 33-ft waves. The NANSHO MARU was east of the center near 52°N, 142°W with 50-kn southerly winds. At 1200, Ocean Station Vessel "P" measured 50-kn northwesterly winds. As the LOW passed onshore near Sitka on the 3d, the GALVESTON, at 54°N, 137°W, felt the wrath of the 50-kn isotach. Gale-force winds were reported throughout the Gulf of Alaska.

Tropical Cyclones, Western Pacific--Two tropical cyclones made December a little more active than usual. Both were tropical storms, and one moved across the Philippines, which have suffered their worst tropical cyclone season on record.

Judy flared briefly in the South China Sea. Her 2-day life was spent off the South Vietnam coast. From 15°N, 112.5°E, she moved southward as a tropical depression early on the 18th. Later, as a tropical storm, Judy moved toward the coast. Winds near her center reached 35 to 40 kn for a few hours. However, she slowed and turned northward near Nha Trang. Early on the 19th, Judy lost her punch.

Meanwhile, Kit was coming to life in the Philippine Sea (11°N, 132°E). Late on the 19th, she reached tropical storm strength, running westward. Kit's winds climbed to 40 kn before she tore through the central Philippines. This was attested to by the DPAE, which encountered 40-kn winds, at 0000 on the 20th. The Islands were enough to disrupt her circulation, and, by the 21st, she was an unorganized cloud mass. However, on the 22d at 1200, the JAPAN POPLAR encountered northerly 40-kn winds 100 mi north of the storm's center. Kit had reorganized near 9°N, 111°E. Winds near her center were estimated at 50 kn as she moved westward. On the 24th, Kit once again weakened, this time near the entrance to the Gulf of Siam.

Casualties--The 11,151-ton SACRAMENTO VENTURE reported being dead in the water 1,200 mi east of Yokohama. Her holds were flooded and leaking as a result of heavy weather on the 4th. The Korean SUSONG (9,871 tons) reported heavy weather damage on arrival at Yokohama on the 10th. The 9,412-ton Panamanian BELLATRIX arrived Honolulu, on the 15th, with a deck buckled due to heavy weather. The Japanese freighter KIHO MARU (2,636 tons) sank in rough water about 1,000 mi south of Tokyo on the 16th. Only one crew member was rescued; 2 bodies were recovered and 20 were missing.

ROUGH LOG, JANUARY 1975--There is some kind of a theory about everything evening out in time and space. It appears to work here, as the North Pacific was below normal in the number of cyclones this month, while the Atlantic was above normal. The tracks were also more diverse. The two major tracks were from Japan into the Bering Sea, and east of Japan into the Gulf of Alaska. The climatological tracks from the central Pacific north of Hawaii into the Gulf of Alaska and Vancouver Island were represented by only one or two storms.

The monthly mean pressure pattern was near the climatological mean in shape and center locations. A 1042-mb High dominated central Asia, the 1003-mb Aleutian Low was near 50°N, 170°E, with a 1004-mb companion Low over the Gulf of Alaska near 56°N, 145°W, and a 1028-mb High was near 34°N, 137°W. This was one of the few times in the last several years

that the central pressure of the Aleutian Low was greater than the climatological mean--1003 mb versus 1000.4 mb.

The anomaly chart was all positive, north of latitude 20°N, except for a minus 5-mb center off Yakutat, Alaska. The largest positive center was 7 mb, near 37°N, 135°W.

The upper-air mean flow also closely paralleled climatology. The gradient was more intense than normal, notwithstanding that the height of the upper-air Low over the Sea of Okhotsk was above normal. This resulted because the pressure surface height over the middle and southern ocean was 100 to 200 ft above the normal mean. The mean windflow was northwesterly off the Asian mainland, turning westerly east and south of Japan, then west-southwesterly east of 180°, and again westerly over the West Coast.

Typhoon Lola was the only tropical cyclone this month.

Extratropical Cyclones--A small LOW was analyzed near 35°N, 154°E, at 1200 on the 1st, on the strength of two ship reports. Twenty-four hours later, it was located near 37°N, 166°E, again using data from only two ships. This indicates how valuable every ship report is that can be broadcast over the radio. At 0000 on the 3d, the LOW had intensified to 989 mb near 42°N, 179°E. The PEARL VENTURE, near 38°N, 170°E, was blasted by 45-kn gales with 20-ft waves. By 0000 on the 4th, the 968-mb center was near 49.5°N, 162°W, and the CAN CONQUEROR was near 46.5°N, 162°W (fig. 46), with 60-kn storm winds on her bow. As the storm crossed the Gulf of Alaska on the 4th and 5th, the GOLDEN RAY and the ESSO NEWARK both reported 40-kn gales. Late on the 5th, it crossed the coast and was wiped out by the mountains.

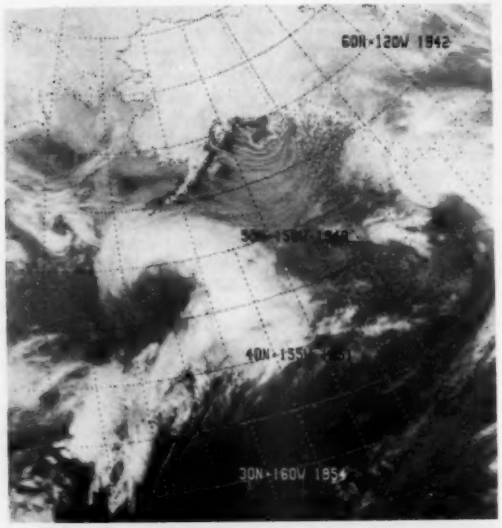

Figure 46.--At 1949 of the 3d, the LOW appears to be in the vicinity of 49°N, 165°W. The clouds over the Gulf of Alaska, particularly just south of Valdez, have an interesting pattern.

Can you believe a 1028-mb LOW? That is how this storm had its origin over eastern Mongolia, on the 3d. It was still only 1012 mb, on the 6th, near 31°N, 158°E, but after that it developed rapidly. Early on the 7th, gales were reported, and, at 1200, the MIDAS SEINE, near 34°N, 176°E, was about 210 mi southwest of the center with 65-kn westerly winds, but only 16-ft seas, on her northerly track.

At this time, another LOW was south of the Aleutians; this LOW passed south of it to be absorbed on the 8th. The HARFLEET (34°N, 173°W) and the THOMAS E. CUFFE (37°N, 169°W) reported 45-kn winds on both sides of the front, south of the southern LOW. The TOYOTA MARU No. 10 was about 120 mi south of the northern LOW, with 50-kn winds. At 1200, there was only the northern LOW remaining on the analysis.

At 0000 on the 9th, the 964-mb storm was headed northeastward south of the Aleutians (fig. 47). The SUMMIT was off the north shore of Umnak Island with

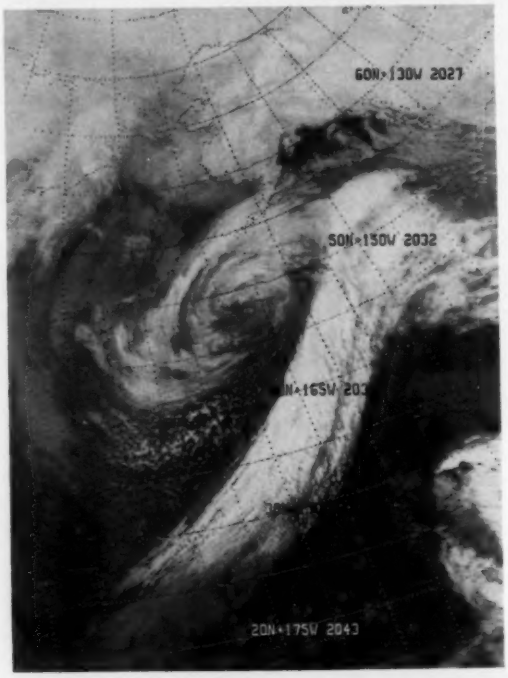

Figure 47.--A wide frontal cloud band precedes the LOW as the center follows in the tracks of many other storms.

65-kn typhoon-force winds. About midway between the island and the LOW, the KASUGAI MARU battled 50-kn winds and 26-ft waves. Southeast of the center, the MYOKEN MARU also braved a 50-kn storm with 16-ft seas and 26-ft swells. Gales continued around the storm as it filled and moved into the Gulf of Alaska. On the 11th, this LOW combined circulations with a LOW moving northward into the Gulf.

This third LOW had originated near 43°N, 147°W. At 0000 on the 11th, the TOYOTA MARU No. 10 had

driven into 40-kn gales near 34°N, 147°W. By 0000 on the 12th, this LOW had deepened to 950 mb near 55°N, 143°W. The HOTAKA MARU was only about 60 mi south of the center, with 50-kn winds, the same as the NANSHO MARU experienced about 180 mi southwest of the center. In this area, the waves were running about 16 ft. It was different for the WORLD PELAGIC, about 140 mi east of the center. She had only 45-kn gales, but the seas were 20 ft and swells, 36 ft.

Later on the 12th, the KOREAN MAIL was headed toward the Alaska Peninsula into a 55-kn storm with 33-ft seas. Other ships, including PAPA, were reporting high gales. On the 13th, the LOW reversed directions and headed westward. The weather hadn't improved for the NANSHO MARU, and she wasn't speeding westward, as the 0000 report was 55 kn. Far to the north, just off Yakutat, the ALASKA STANDARD was headed into 50-kn winds. The buoys EB-03 and EB-33 appeared to be reporting reliably. EB-03 reported 26-ft seas. To the south, PAPA was radioing 45-kn gales with 30-ft seas. The storm could not survive a westward track for long and was deteriorating. By 1200 on the 14th, the pressure had risen to 1006 mb, but the WASHINGTON MAIL still managed to find 50-kn winds. Twelve hours later, the LOW was gone.

The East China Sea contributed this storm to the coastal seamen and fishermen of the western Pacific. It moved over Japan bringing rain to the lower elevations and snow to Korea. By 1200 on the 22d, the pressure had dropped to 989 mb northeast of Tokyo. At this time, it was snowing over northern Honshu. South of the center, near 30.5°N, 142.5°E, the aptly named NIPPON MARU was headed for Tokyo Bay with 40 kn on her stern. At 0000 on the 23d, the OJI was only 60 mi southwest of the 972-mb center, with howling 65-kn northwesterlies (fig. 48). Forty-five-knot winds were blowing to the south and northeast of the center. Gales continued all around the storm as it moved northeastward along the Kuril Trench. Waves up to 20 ft were also reported. The storm continued deepening to 956 mb as it crossed the Bering Sea. The pressure gradient indicated that winds stronger than gales could have been present, but they were not broadcast.

The center crossed into eastern Siberia, on the 26th, then turned sharply eastward to pass over the Bering Strait and disappear into the frozen Chukchi Sea.

A LOW formed in an area of weak pressure gradient, off the east coast of Japan, on the 27th. Nothing much occurred in the first 12 hr, but by 24 hr, a well-developed storm was raging. The SURUGA MARU at 40.5°N, 156°E, and the RYOKKO MARU at 39.5°N, 150°E, had 45- and 40-kn winds on opposite sides of the center. This storm was also headed toward the Bering Sea. Again only gale-force winds were reported, until 1200 on the 29th, when the 956-mb center was near 51°N, 164°E. The SHOYO MARU broke the pattern with a 55-kn report from 51°N, 159°E. A ship north of the center reported 26-ft seas.

As the LOW passed northward west of Ostrov Beringa (fig. 49), that island was ravaged by 70-kn winds from the south. The temperature was 0°C. The map 12 hr later still indicated 70-kn winds, with 55-kn winds reported over the Kurils. Forty-five knots was the highest ship report. The storm was dying as it moved across Siberia into the East Siberian Sea, on the 31st.

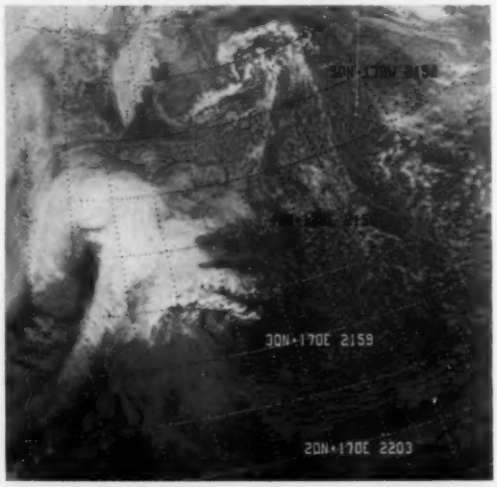

Figure 48.--The warm Kuroshio Current was a readily available source of energy for this rapidly developing storm.

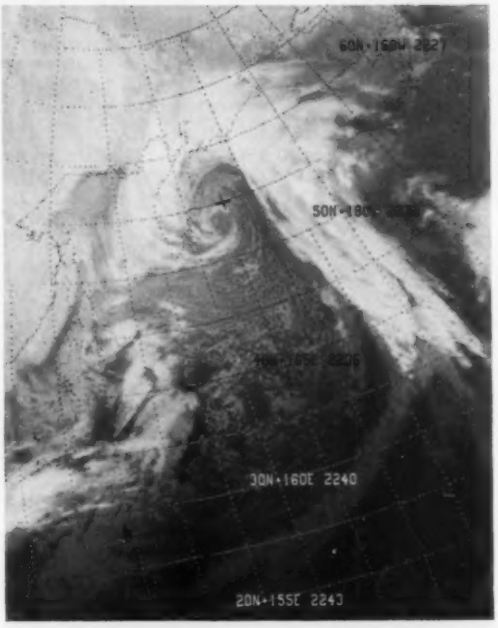

Figure 49.--It doesn't take much imagination to visualize the freezing 70-kn winds that paralyzed the island of Ostrov Beringa.

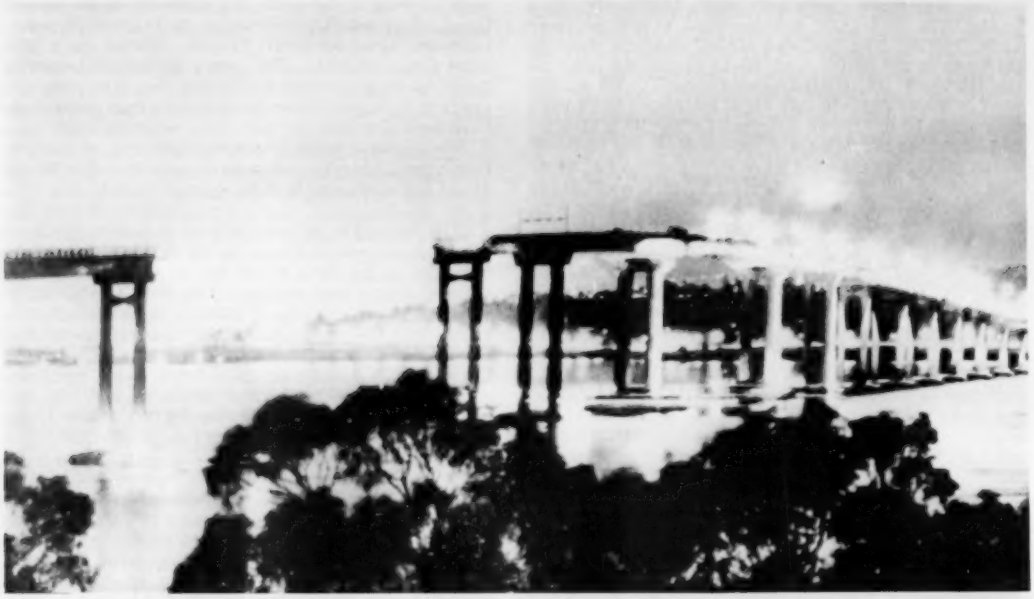

Figure 50.--Rain and fog hampered the efforts to rescue the two crewmen from the LAKE ILLAWARRA and passengers in the automobiles that fell in the river when the bridge collapsed. Wide World Photo.

Tropical Cyclones, Western Pacific--Lola developed near Palau Island, on the 22d. She moved westward toward Mindanao. Late the following day, she reached typhoon intensity near 9°N, 130°E. Winds near her center reached 70 kn, and gales extended out 200 to 300 mi before Lola crashed into northern Mindanao, on the 24th. She quickly lost typhoon strength and turned toward the west-northwest. By the 25th, Lola was into the South China Sea. Her maximum sustained winds remained at 40 to 50 kn for the next several days. During this period, the 4,031-ton Panamanian-registered freighter GULF BANKER sank 170 mi west of Manila. All 31 crewmembers were rescued by the U.S. Navy escort ship MEYERKORD. The storm finally fizzled out on the 28th before reaching land.

Winds and a storm tide were destructive in the Philippines. Lola left more than 15,000 people homeless, and an estimated 31 dead. Most of this death and destruction occurred in the clusters of islands in the Visayas. The storm tide struck the eastern shores of Tandag.

Casualties--The 7,274-ton ore carrier LAKE ILLAWARRA struck the Tasman Bridge (fig. 50) across the Derwent River, and a 240-ft section fell into the river. The ship sank, 2 crewmen were lost, and up to 12 persons were in automobiles that fell into the river. The 11,025-ton Liberian WILSHIRE BOULEVARD reported heavy-weather bow damage on arrival at Shinaizu. The American tug DAVID FOSS sank in Cook Inlet, on the 11th. The vessel suddenly began filling with water, and the crew abandoned ship in adverse weather. The crew was picked up by helicopter. The 10,000-ton Liberian tanker FLORENCE and the 1,526-ton Greek freighter MINIMABOR collided in a storm off southern Japan, on the 12th. Both continued on their way.

The 27,506-ton tanker BRITISH AMBASSADOR sank, on the 13th, while being towed by the tug ARCTIC. The Indian-registered MARATHA PROVIDENCE (22,593 tons) sustained heavy-weather damage on a voyage from the U.S. west coast to Singapore. The 945-ton Japanese freighter GOYO MARU No. 21 sank in heavy seas off western Japan, on the 18th. Seven crewmen were found dead, and five are missing. The Liberian oil tanker NORFOLK (20,915 tons) struck the Benicia-Martinez bridge at Martinez, Calif., in dense predawn fog, on the 22d.

Marine Weather Diary

NORTH ATLANTIC, APRIL

WEATHER. During April, weather conditions over the middle and northern latitudes are generally much more settled compared to the preceding month. Thus, intervals of favorable weather are more frequent and usually of longer duration. There is a notable reduction in the frequency and intensity of winter-type LOWs. The 1007-mb Icelandic Low lies off Kap Farvel near 59°N, 41°W. The Azores High (1021 mb) is centered more than 1,700 mi farther south near 30°N.

WINDS. The prevailing wind north of 40°N is generally from the westerly quarter of the compass except over the Norwegian Sea, where winds are quite variable. Within this large belt, about 55 percent of the observations report winds of force 4 to 6. From about 40°N southward to the northern boundary of the trades, the prevailing wind is mostly southwesterly, although winds with an easterly component are prevalent off the east coast of Florida out to 70°W, and over the Gulf of Mexico. Near the coasts of Morocco and Portugal, northerly winds dominate, and westerly and northwesterly winds hold sway over the Mediterranean Sea. The winds north of the trades and south of the westerlies are weaker than their counterparts north of 40°N--only about 45 percent of all observations yield winds of force 4 to 6. The trades are more firmly entrenched in April, as compared to March. They usually prevail south of 25°N and, in the eastern North Atlantic, extend to about 30°N. Fifty to 75 percent of the time, they are force 3 to 4.

GALES. The area subject to gales decreases greatly in the middle and northern latitudes, compared to March. The most southern point of the 10-percent frequency boundary has moved northward to 53°N, 45°W. The area affected is enclosed by that point to 60°N, 15°W, to 62°N, 25°W, to 65°N, 28°W, to 63°N, 55°W, to 53°N, 45°W. A small area (about 6° square) of 10-percent frequency is centered east of the Grand Banks near 47°N, 38°W. Gales also spread over the Gulf of Lions about 10 percent of the time.

EXTRATROPICAL CYCLONES. Principal areas of cyclogenesis during the spring months (March, April, and May) are found in a broad area from Cape May down to Georgia on the United States east coast, eastnortheastward out to the central ocean, including the waters around Newfoundland. Within this region, cyclogenesis is concentrated from the coasts of Virginia and North Carolina northeastward to a point near 39°N, 66°W. Other principal areas of cyclogenesis lie around the south coast of Iceland; over most of the Baltic Sea, including Danish waters, but not including the Gulf of Bothnia; off Norway's arctic coast; over the Bay of Biscay; and over the Gulf of Genoa, the northern and central Adriatic Sea, and the southwestern Black Sea. Primary storm tracks in April are much the same as in March. One track begins about 250 mi east of Cape May and travels northeastward over the Grand Banks. The storms heading northeastward across the North Atlantic tend to pass a little farther south of Iceland than in March. Over the Mediterranean, the primary storm track reaches northern Italy, but does not extend to southern Turkey as it did in March.

TROPICAL CYCLONES have not been reported during April in the North Atlantic in the past 104 yr. This is the only month of the year in which no tropical storm activity has occurred.

SEA HEIGHTS of at least 12 ft are found more than 10 percent of the time north of a line extending from Labrador around the eastern margin of the Grand Banks to 41°N, 50°W, westward to 70°W. The same line curves eastward along the 36th parallel to 60°W, and then across the North Atlantic to Ireland and central Norway. Another small area of 10-percent frequency extends from the Gulf of Lions southeastward to a distance of 150 mi out over the Mediterranean. An elliptically shaped area of 20-percent frequency extends from latitude 55° to 60°N, and across longitudes 15° to 55°W.

VISIBILITY. Occurrences of low visibility increase over the western part of the North Atlantic, especially west of 40°W. The greatest change from March takes place over the Grand Banks and the waters south and east of Newfoundland, where over 20 percent of the observations show visibilities of less than 2 mi. Visibility over the Norwegian Sea has decreased in the west and increased in the east. The area of 10-percent frequency of low visibility over the North Sea has moved southwestward and extends from the tip of southern Norway to the coast of Great Britain.

NORTH PACIFIC, APRIL

WEATHER. The weather over the North Pacific generally shows marked improvement over that of any month since October. Compared to the winter months, periods of storminess are fewer, but severe extratropical LOWs are still encountered occasionally. The Aleutian Low has filled to three 1009-mb centers along 55°N. Its configuration is that of a banana, bridging from the Gulf of Alaska to the Sea of Okhotsk. The 1012-mb isobar orientation has changed very little over the past months, except the southern boundary has moved steadily northward with spring, now approximating 50°N. The three LOWs are located just east of Kamchatka, in the middle of the Bering Sea, and in Bristol Bay. The Pacific High is expanding with two major centers near 32°N, 159°W, and 32°N, 178°W.

WINDS. Over about half of the North Pacific between 40° and 55°N, the windspeeds are of force 4 to 6 in 50 to 65 percent of the observations. The remainder of this latitudinal belt, especially near the coast of North America, experiences winds of force 3 to 5. The prevailing winds are from the westerly quarter. Between 30° and 40°N, winds are variable west of 170°E, mainly southwesterly between 170°E and 150°W, and westerly to northerly east of 150°W. Forces 3 to 5

are recorded in 45 to 70 percent of the observations. Variable force 5 winds often blow over the western half of the Bering Sea, and northerly force 5 winds are quite common over the eastern half. Easterly winds of about force 4 sweep over the northern Gulf of Alaska. South of Japan, easterly force 4 winds prevail, and winds from any direction except west and southwest are common over the East China Sea, where force 3 to 4 is the rule. The "northeast trades" prevail south of 25°N, over the western ocean between the dateline and the Philippines, and south to 30°N over eastern waters. The trades blow at about force 4, except near the Equator and over the Philippine Sea, where force 3 winds prevail. The northeast monsoon continues to dominate the South China Sea, but with less strength and steadiness than in the colder months. Winds of force 2 to 3 account for between 46 and 63 percent of all observations. Northerly winds continue to prevail south of the Gulf of Tehuantepec, but gales over the Gulf now occur less than 5 percent of the time. Force 2 to 3 winds are experienced 50 percent of the time, compared to 40 percent in March.

GALES. Two areas of high gale frequencies, 10 to almost 20 percent, persist as a residual of the winter month in the middle and northern latitudes. One holds sway over the Gulf of Alaska south of Kodiak Island to about 52°N, and eastward to near 140°W. The other is a belt 250 to 370 mi wide that lies east of Honshu from about 36°N, 147°E, northeastward to about 45° to 48°N, and 178°E.

EXTRATROPICAL CYCLONES. The principal area of cyclogenesis stretches from south of Kyushu northeastward to about 700 mi south of Beringa Island. A primary track from across Sakhalin Island combines with the one above and follows the Aleutian Islands into the Gulf of Alaska. About 180°, a branch shoots off to the northeast toward, and over, the Pribilof Islands. About midway between Hawaii and Adak, a track points northeastward toward Yakutat. A secondary cyclone path enters British Columbia near the southern tip of the Queen Charlotte Islands. The storm tracks have moved slightly northward over the western waters. The intensity of the storms has started to decrease, resulting in fewer gales.

TROPICAL CYCLONES. In an average 10-yr period, about seven tropical storms can be expected over Far Eastern waters. About 80 percent of these, or 4 out of 5, have developed to typhoon strength. Tropical cyclones develop in the same region as they did in March, east of the central and southern Philippines and west of 170°W, but the area affected by these warm-core storms has expanded northwestward to include the waters east of Luzon and around Taiwan. A tropical cyclone in the eastern North Pacific in April would be a rarity.

SEA HEIGHTS. The area where there is at least a 10-percent frequency of 12-ft, or higher, seas is roughly bounded by 155°E and 150°W on the west and east, 52°N on the north, 32°N on the southwest corner, and 45°N on the southeast. An area of 10-percent frequency of swells equal to, or greater than, 12 ft parallels the coastline of North America, including the Aleutian Islands, and joins the western half of the above area.

VISIBILITY. Reduced visibility (less than 2 mi) of 10-percent, or greater, frequency extends to the north of a line drawn from Sakhalin southeastward to about 40°N, 160°E, and then east-northeastward to about 45°N, 175°W. From there the line swings northward to Amlia Island in the eastern Aleutians, and then eastward to about 50°N, 150°W, before cutting back across the Alaska Peninsula to the Bering Sea, east of St. Lawrence Island. The area of 20-percent frequency has decreased in size since March and is now centered over the northern Kurils.

NORTH ATLANTIC, MAY

WEATHER over the North Atlantic continues to moderate during May. The Azores High builds slightly to a central pressure of 1022 mb near 31°N, 40°W, while the Icelandic Low centered several hundred miles southeast of Greenland's southern tip fills to about 1012 mb.

WINDS over the greater part of the ocean between 40° and 55°N are generally westerly, except northeasterly over the Baltic Sea, but with less persistence than earlier in the spring. The average windspeed north of 40°N is force 4. Winds are quite variable between 55° and 60°N and are generally northerly north of 60°N. Between 25° and 40°N, winds are somewhat lighter, generally of force 3. West of 40°W, within the above latitudinal belt, south and southwest winds tend to prevail; while east of this longitude, winds from the northerly quarter of the compass are by far the most frequent of all. Over Mediterranean waters, westnorthwesterly winds of force 2 to 3 are the most common. The Gulf of Mexico plays host to easterly force 3 winds. The "northeast trades," force 3 to 4, dominate the wind regime between 5° and 25°N, except along the African coast, where they extend northward to about 30°N. South of 5°N to the Equator, the force 2 to 3 winds almost always have an easterly component.

EXTRATROPICAL CYCLONES continue to develop frequently from off the Carolina coast northeastward to Newfoundland, but are becoming less severe. The direction of movement from Newfoundland is generally either north toward the Davis Strait, or northeast toward the Norwegian Sea. Two primary tracks affect the Great Lakes. One runs east-southeastward from Lake Winnipeg to south of James Bay. Another follows a line from eastern Iowa across southern Lake Michigan and southern Lake Huron to lower Quebec. After meeting, the two tracks proceed as one to the Gulf of St. Lawrence.

GALES are rare below 40°N, and their frequency and duration in higher latitudes are less than in the preceding months. The area of maximum likelihood of gales, 10 to 20 percent, generally is located from the southern tip of Greenland southward to about 52°N, between 40° and 56°W.

TROPICAL CYCLONES are infrequent during May. During the 44-yr period 1931-74, nine tropical storms have occurred, and two of them attained hurricane force.

SEA HEIGHTS of 12 ft or more are encountered from 5 to 10 percent of the time along the northern shipping lanes, from several hundred miles east of the Chesapeake Bay to the northern Norwegian coast, excluding the North Sea and the Bay of Biscay, but including the Gulf of Lions southeastward to Sardinia. The frequency increased to more than 10 percent in the midocean area and to more than 20 percent south of Kap Farvel.

VISIBILITY limited to less than 2 mi is encountered 10 to 20 percent of the time over the western North Atlantic, from about 40°N, 65°W, northeastward to a point near 53°N, 30°W, and then westward to the Labrador Sea. The line, north of which frequencies are greater than 10 percent, but less than 20 percent, then extends northeastward over Kap Farvel to north of Iceland, and through the Norwegian Sea to the Barents Sea. Visibility less than 2 mi also occurs between 10 and 20 percent of the time over a great part of the northeastern North Sea. Frequencies increase to over 20 percent of the time over the Grand Banks and off the southwest coast of Greenland.

NORTH PACIFIC, MAY

WEATHER continues to improve slowly over the North Pacific in May. The subtropical High has an average central pressure of about 1022 mb and is located near 34°N, 152°W. The Aleutian Low becomes a broad weakening trough extending from the Asian mainland eastward to the western Gulf of Alaska. The lowest pressure, about 1008 mb, is centered over the west-central Bering Sea.

WINDS north of the 25th parallel tend to come from the westerly quarter of the compass, but variable winds are present over a number of locations on either side of the dateline. Winds over the Gulf of Alaska are easterly at force 3 to 4. Along the coast of the United States, northwesterly components are pronounced. Between the Equator and 25°N, (30°N, east of 180°), the "northeast trades" are very steady, except over the southern half of the South China Sea, where southerly winds of the southwest monsoon have established themselves. These monsoon winds are usually force 2 to 3, though lighter winds are not unusual. Over most of the rest of the North Pacific, windspeeds average force 3 or 4. Northerly and westerly winds prevail out from the Gulf of Tehuantepec, with easterly and northwesterly winds close behind. Speeds are force 2 or 3, 48 percent of the time.

EXTRATROPICAL CYCLONES continue to develop over the Ryukyus and then move east-northeastward toward the Gulf of Alaska. A second primary storm track crosses the Siberian coast and Sakhalin, continues eastward across the northern Kuril Islands, and then curves toward the southern Bering Sea.

GALES decrease in frequency. In midocean between 40°N and the Aleutians, the chance of encountering gale-force winds remains slightly above 5 percent. Two smaller areas of similar frequency are found near the Alaska Peninsula and over the southern part of the Gulf of Alaska.

TROPICAL CYCLONES. Tropical storms occur, on the average, slightly more than once each year over the western ocean. There have been some years with none, but some with as many as four. Roughly 75 percent of these tropical storms become typhoons. The areas of most frequent development are south of 20°N, from the Carolines westward across the Philippines and the South China Sea. About once every 2 yr, a tropical storm or hurricane develops over the ocean area off Mexico during May.

SEA HEIGHTS. Seas of 12 ft or more continue to decrease in frequency as the winds decrease. The area of 10 percent or greater has the shape of a long balloon squeezed in the middle. The northern boundary parallels the Aleutian Islands about 400 mi to the south, between 160°E and 148°W. The southern boundary is 40°N over the western, and 45°N over the eastern ocean. High swells continue to be observed off the Asian and northern coasts, with a larger area in midocean very roughly bounded by 30° and 50°N, 155°E and 170°W.

VISIBILITY less than 2 mi occurs more than 10 percent of the time over the western North Pacific Ocean north of 35°N, and over the eastern North Pacific Ocean north of 42°N and west of 140°W, excluding the Gulf of Alaska and the waters southeast of the central Aleutians. Over the northern Kurils, this low visibility occurs more than 30 percent of the time.

WE OF NOAA ARE MAKING USE OF THIS SMALL AMOUNT OF SPACE TO EXTEND OUR THANKS TO ALL THE SHIPS' OFFICERS WHO ROUTINELY TAKE SHIPBOARD WEATHER OBSERVATIONS. TO US, THESE EXCELLENT OBSERVATIONS ARE PRICELESS. WE CERTAINLY DO APPRECIATE RECEIVING THEM ON A REGULAR BASIS.

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ADDRESSES OF NATIONAL WEATHER SERVICE PORT METEOROLOGICAL OFFICES

NOAA National Weather Service Port Meteorological Offices have personnel who visit ships in port to check and calibrate barometers and other meteorological instruments. In addition, port meteorologists assist masters and mates with problems regarding weather observations, preparation of weather maps, and forecasts. Meteorological manuals, forms, and some instruments are also provided.

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